

THE MOTORSHIP FLEET OF A GREAT OIL COMPANY

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MOTORSHIP

Devoted to Commercial and Naval Motor Craft

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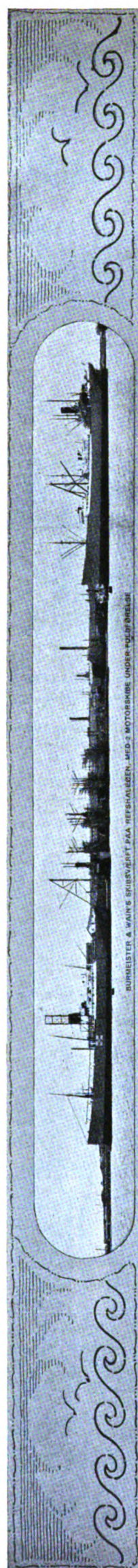
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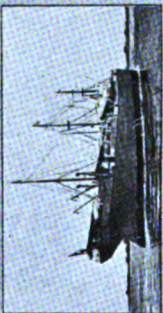
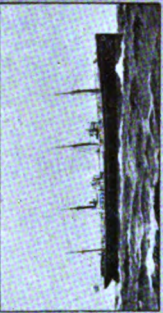
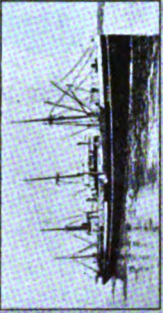

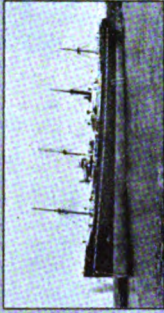
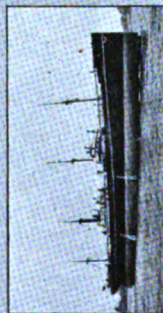
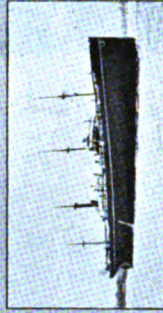




New Orleans

London

Christiania

Without Such Ships as these America Cannot have a Successful Mercantile Marine! Yet, To-day Not Even One Merchant Motorship of this Size Flies Our Flag



 SELANDIA DET ØSTASIATISKE KOMPAGNI	 CHRISTIAN X HAMBURG AMERICA LINE	 SUECIA A.B. NORDSTJERNEN, STOCKHOLM	 SIAM DET ØSTASIATISKE KOMPAGNI	 ANNAM DET ØSTASIATISKE KOMPAGNI	 PEDRO CHRISTOPHERSEN A.B. NORDSTJERNEN, STOCKHOLM
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NOTEWORTHY ECONOMIC MERCHANT SHIPS—Nos. 6 to 29

The above fleet of Diesel-driven steel motorships are the product of a single European shipyard that has been hampered in production and output for the past four years by the scarcity of materials, namely, Burmeister & Wain, of Copenhagen, Denmark. These vessels range from 7,000 to 11,000 tons d.w.c. and have from 10 to 14 knots loaded speed. Yet today there is not a single American-built full-powered Diesel-driven steel merchant ship of this size and speed in service or on order, with the exception of the U. S. Navy tanker "Maumee." With such an imposing array of economical motorships before us, it is hard to understand why America has tarried so long, and why we still are delaying over the utilization of our splendid domestic oil-engine building facilities. To-day most of our oil-engine factories are starving for want of orders. They deserve better encouragement

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The oil-engined motorship has arrived! It is such a pronounced economy that it was bound to come. Nothing could stop it! And all obstacles have been removed as fast as they arose. The law of progress has seen to that. Very strong prejudices stood in the way of steam. But, one after another they were swept aside and steam reigned triumphant for a century. Steam now has had its day! Its zenith has passed, and gradually but surely it is being superseded by the economical internal-combustion power. America, the most important oil-producing country, is to be the greatest motorship-owning nation. Let us all co-operate and assist to make that day soon.

May, 1919 Vol. 4 No. 5

EDITORIAL

OUR WOODEN SHIPS.—TURN THE FIASCO INTO SUCCESS

PRACTICALLY no one in the shipping industry will now refuse to admit that the coal-burning wooden steamship is a failure as a sea-going carrier, and that it has no place in our peace-time merchant marine, as well as being useless as a war-time freighter. This, however, was clearly demonstrated in our columns at the time of its earliest conception when Goethals and Denman were in charge of Federal merchant shipbuilding. Nevertheless, the attempt to construct wooden vessels to meet the emergency then existing was fully justified. The error was the "passing over" of a class of machinery, which by reason of its extraordinary economy would have made them at least workable, and in installing machinery which made them impracticable and almost useless.

However, we have got several hundred of these ships at a cost of millions of dollars, and it is proposed to "scrapheap" most of them, and turn others into sailing-ships and barges for which they are totally unsuitable. All these completed ships and hulls simply cannot be wasted, as by using the Diesel oil-engine a large number can be turned into economical cargo-carriers for the Pacific-Alaskan and Atlantic coastwise trade, for operating in the lumber trade, also for trading between Pacific and the Atlantic. For this purpose 100 to 150 of the best hulls could be selected by the Shipping Board and be fitted with oil-engines.

We fully realize that the modern wooden hull is not favorable to reliable operation of the heavy-oil engine, but if the hulls selected are well built—and there are such—we anticipate very little trouble, but in fairness to the Diesel engine, such engines should be ordered as an extra and the motors now on order for steel ships **should be installed in steel ships**, and given every opportunity to prove their worth. Many oil-engine builders—grossly neglected during the war—are now literally crying for orders, which private shipbuilders cannot place because of the unsettled state of the Government's shipping policy.

Mr. Hurley has before him a splendid opportunity, and all the facilities available, to turn the wood-ship fiasco into a comparatively successful fleet. A single Diesel engine (with surface-ignition auxiliaries) of about 1,500 i.h.p. in each ship will drive these vessels at an average loaded speed of between eight and nine knots on a fuel-consumption of about $4\frac{1}{2}$ tons per 24 hour day. This means a radius of about 6,120 miles on a bunker of 135 tons, thus giving the vessel ample cargo space—hitherto impossible with steam-engines and boilers. Less than ten men will be required in the engine-room, and the fuel bill will not exceed fifty dollars per day, with oil at \$1.50 per barrel. Possibly one 1,100 i.h.p. or two 600 i.h.p. oil-engines could be installed instead of one of 1,500 i.h.p.

THE U. S. SHIPPING BOARD AND FUEL-OIL

RECENTLY the U. S. Shipping Board advertised for bids to supply 31,299,480 barrels of oil-fuel, estimated to cost 35 to 40 million dollars. This brings out in a most forcible manner the remarkable advantage of Diesel motorships over oil-fired steam-vessels, and a contract for ten million barrels was recently placed with the Standard Oil Company.

The above quantity of oil would be sufficient to propel a fleet of 35,770 **motorships**, each of 9,500 tons d.w.c., a distance of 3,120 sea-miles per vessel, all at 13 knots average loaded speed. This represents an aggregate of 111,602,400 sea-miles.

The same amount of oil would only propel 11,766 **steamships** of the same dimensions and speed the same distance.

As each Diesel **motorship** would carry 8,925 tons of net cargo, compared with about 7,970 tons of net cargo by each of the oil-fired **steamships**, the entire fleet of **motorships** would carry 319,257,250 tons of net cargo a distance of 3,120 nautical miles on the quantity of oil to be purchased by the U. S. Shipping Board. At \$25.00 per ton for freight these cargoes would represent a gross income of \$7,981,431,250.00 to the **motorship** owners.

But the fleet of **steamships** (that the same quantity of fuel would propel) could only carry 93,775,020 tons of net cargo, which would represent a gross income of \$2,344,375,500.00 to the **steamship** owners.

This means a clear gross gain of \$5,637,055,750.00 for the **motorships** without taking into consideration other remarkable economies.

In working out these figures we have taken $87\frac{1}{2}$ barrels as the daily consumption of each **motorship** and 266 barrels as the daily consumption of each **steamship**. The results plainly show how a great **motorship** fleet would enable America to operate her merchant marine in competition with all other nations, regardless of the higher wage, and higher construction costs.

THE PRICE OF FUEL-OIL

THERE have been many shipowners who, believing that the price of fuel-oil never again would drop to its pre-war level, have considered it inadvisable to turn serious attention to oil-burning motorships. Doubtless those who had formed this opinion received not a little surprise when the bids for fuel-oil were opened by the U. S. Shipping Board and the quoted prices revealed. The prices ranged from \$0.24 per 40-gallon barrel at Mexican ports, to \$1.25 at New York; \$1.60 at San Francisco, and \$2.15 at Honolulu.

Present Position of the Diesel Engine as Applied to Marine Service

By the Editor of "Motorship"

(Paper Read at the Joint Meeting of the Metropolitan Section of the Society of Automotive Engineers, and the Society of Mechanical Engineers, April 9, 1919)

IT is hardly necessary to mention that the four years of war have been a great impediment to extensive adoption of the merchant-type of marine-Diesel heavy-oil engine. As is well known, the cry was *ships, ships, and ships*, for the thousands of tons of merchandise and munitions that were waiting for months on the docks of the world's ports.

The entire absence of customary trade competition and the high prevailing freight-rates made it unnecessary to effect economies of operation; and, as the ships of all nations have been more or less in the hands of the various governments, only the more progressive shipowners who had eyes on the future, evinced interest in motorship construction. In Great Britain the demands for naval vessels, of course, retarded merchant Diesel engine development, but some oil-engined monitors with 15-in. guns were placed in service, also some large and small merchant motorships.

Again, many shipbuilders of neutral countries made slow work of delivering such motorships as were on order with them because of the great difficulty in securing materials. Nevertheless, quite a considerable number of ocean-going motorships were laid down or launched in Europe. In our own country a new type of merchant ship was developed during the war period—namely, the large wooden-auxiliary. Unfortunately, this type of vessel was unsuccessful in many instances, due principally to the following five reasons:

(a) Most of the hulls were constructed of green timber by inexperienced builders, and the hogging and warping of the hulls assisted in causing unreliability of their machinery.

(b) They had insufficient canvas to make profitable speed under sail alone.

(c) Their auxiliary power was insufficient to drive the vessels at profitable speed without the sails and a favorable breeze, and sometimes with all those.

(d) Also, these craft, which were built as auxiliaries, were operated as full-powered ships, resulting in continually forcing the engines to their limit of power, which did not tend for reliability.

(e) Inexperienced engineers placed in charge, instead of owners having sent engineers to engine-builders' works for several months while the vessels and motors were under construction.

It should be borne in mind that many of these vessels have a loaded-displacement of over five thousand tons, yet in no case was over seven hundred horsepower installed. Less than 150 h.p. per 1,000 tons is not much use as a propelling medium.

Oil-engines of this power should only have been used when entering harbors, or during calms and adverse winds as an aid to the sails. But, they have been used as a main propulsion medium for 20 and 30 days at a stretch, such as on voyages from the Pacific coast to Australia.

This ill treatment of a promising type of cargo-carrier has been most unfortunate, as instances where such vessels have been properly built, properly installed with a good oil-engine, and properly operated, conclusively demonstrated that the motor-auxiliary can more than hold its own against the coal-burning, or oil-fired, full-powered steel steamships, particularly on services favored with trade winds.

However, I would recommend steel-built hulls for this class of freighter. If the auxiliary power is to be used fairly constantly at sea, I would advise the following powers:

Loaded Displacement	Power	Fuel Consump. for 24 hrs. Running	Average Loaded speed without Sails
2,000 tons	500 B.H.P.	14 to 16 barrels	7-½ knots
3,000 tons	700 B.H.P.	21 to 23 barrels	8 knots
4,000 tons	900 B.H.P.	24 to 28 barrels	8-¼ knots
5,000 tons	1100 B.H.P.	32 to 36 barrels	8-½ knots

During the war a number of full-powered wooden and steel motorships of 1,000 to 4,000 tons were built in this country and fitted with Diesel engines of domestic design or domestic constructions. Generally speaking, these ships have given most excellent service, although some are by no means ideal in design. Their total power per vessel is up to 1,000 b.h.p.

As regards large full-powered steel motorships, America lost a splendid opportunity during the war to construct a great fleet of such vessels, which at the present time and in the near future would be of incalculable value to the nation. This was not done, because the official view was that the war period was too urgent to allow of experimenting with Diesel-engine power.

However, another experiment was adopted instead; namely, the geared-turbine, which has not resulted in the success anticipated, and judging by actual results it would undoubtedly have been far better to have built motorships, both for war emergencies and for after-war trade.

Yet, Italy during the war decided to build Diesel-driven motorships for her "emergency merchant fleet" and one yard alone arranged to launch every year not less than 18 standardized steel motorships of 8,000 to 10,000 tons deadweight-capacity. I refer to the Ansaldo-San Giorgio Ltd. of Spezia.

No country was in greater need of cargo ships than Great Britain, yet during the most critical period of the submarine warfare she laid down and launched the highest-powered and fastest merchant motorship ever built. This is the "Glenapp," a transport-freighter of 470 ft. length and 55 ft., 8 ins. beam, and of 14 to 15 knots speed. Her Diesel engines each have eight cylinders 760 mm. (29.921 ins.) bore, by 1,000 mm. (43.307 ins.) stroke, and together develop 6,600 to 7,000 indicated-horsepower at 110 to 125 r.p.m. on the four-stroke cycle. If great Britain could "experiment" during the war, why couldn't America? An answer is not easily forthcoming!

Another large four-cycle Diesel-driven British motorship placed in service during the war is the "Santa Margherita," a vessel of 11,000 tons deadweight-capacity and of about 14,000 tons loaded displacement, and of 2,500 brake-horsepower at 130 r.p.m. from two engines, each having eight cylinders 20.7 ins. stroke by 33 ins. stroke.

The most important feature of these particular engines is that they are of the solid-injection type, and so dispense with compressed-air injection of fuel. Their builders are Vickers Ltd. of Barrow, who have had considerable experience with solid-injection in connection with their high-powered six, eight, and twelve-cylinder submarine engines.

Speaking of solid-injection "Diesel" engines, the British firm of Doxford & Sons are now engaged in the most radical and important marine oil-engine development ever attempted, and one which should be watched with great interest by all engineers.

They are building some standardized 11½-knot single-screw motorships each fitted with a four-cylinder two-cycle type "Diesel" engine of 3,000 indicated-horsepower at 77 revolutions per minute. The five outstanding features of this engine are as follows:

(a) Solid-injection of fuel.

(b) Opposed-piston type of engine.

(c) Have larger output per cylinder than any other Diesel engines under construction for marine work.

(d) Lower revolution-speed than any other design of Diesel engine.

(e) Low fuel-consumption for a two-cycle type engine—the same being guaranteed at 0.42 lb. per shaft h.p.

This engine—which, strictly speaking, is not a true Diesel engine—has a cylinder-output of 750 indicated-horsepower, or, approximately, 500 brake-horsepower. This engine will burn oils of 0.96 specific gravity and containing 30 to 35 per cent of asphaltic matter. Cammell Laird & Co. of Birkenhead, England, also are developing a new opposed-piston type of Diesel engine, which offers great possibilities.

Sulzer Freres of Winterthur have placed in service two six-cylinder two-cycle type Diesel engines of 4,000 to 4,500 brake-horsepower each. These, however, are stationary engines, and one is in France, and the other at Harland & Wolff's dry dock. But, there is no reason why such engines cannot now be built for marine work.

In fact, it is my opinion that a successful six or eight-cylinder Diesel engine of 5,000 brake h.p. (6,500 i.h.p.) could be built today. So that an order for a triple-screw liner of about 20,000 i.h.p. or a twin-screw freighter of 13,000 i.h.p. could with safety be placed today by a shipowner with sufficient courage and foresight, or by the Shipping Board. The latter ship would mean

a 16-knot freighter of 20,000 tons capacity. With drawings and assistance from abroad the engines could be built in the United States.

As this vessel would have a fuel-consumption of only forty-three (43) tons of oil-fuel per 24-hr. day at full speed, and would not need more than 20 men in her engine-room, such a freighter would revolutionize long-distance cargo carrying. The advantages are so tremendous that the United States Shipping Board could well afford to order at least one vessel today. In fact, it is rather surprising that such a vessel has not been ordered, as none of the motorships now contemplated by the Shipping Board will show any advancement over foreign motorships already in service, so if the fleet of 9,800-ton vessels are built, we shall still be behind European engineers in development and progress. Surely we should make at least one attempt to go a stage in advance of our friends across the sea?

Toward the end of the war the Shipping Board Emergency Fleet Corporation turned some attention towards the motorship and during last summer decided to build 36 "submarine-evading" cargo-ships of special design, each of 5,500 tons capacity, and for these vessels ordered 52 McIntosh & Seymour Diesel engines and 20 Skandia-Werkspoor Diesel engines, all of 750 to 850 b.h.p.

Meanwhile, the hulls are being re-designed, and 50 per cent of the order for the engines has been cancelled. In my opinion, it was a very grave mistake on the part of the officials who were responsible for having made this large cancellation instead of having changed part of the order to Diesel engines of at least double the power, suitable for fast freighters of about 8,000 to 10,000 tons deadweight-capacity. Evidently there has been some oversight which, it is to be trusted, will be rectified as soon as possible by Messrs. Hurley, Rosseter and Ackerson. There is no logical excuse for this cancellation because, while it is true that many steam-engines also have been cancelled, other steam sets are still being completed and installed in cargo vessels.

There has been some talk that there are no available funds, in which event, steps should be taken to obtain money for this purpose. I feel confident that Congress will be willing to make a special appropriation for motorships.

Under the revised shipbuilding program the Shipping Board proposes to build some 9,800 tons-capacity twin-screw motorships. They will be of 13 knots speed and 4,000 shaft horsepower. Orders for two twin-screw Diesel sets, each of 4,300 indicated-horsepower, have already been purchased by Mr. Hurley from Burmeister and Wain of Copenhagen, Denmark.

There have been rumors to the effect that many, if not all, the engines for these ships may be of one design and may be constructed abroad, but erected in the U. S. A. Certainly no order as yet has been placed for engines for these particular ships with the two domestic firms that have had part of their order for Diesel engines cancelled. One might reasonably inquire why their orders have been cancelled when engines are being purchased abroad. In America we can build an equally good engine as any foreign engineering concern, for we now have the very latest European designs and technical information in addition to our own experiences.

It is to be hoped that the Shipping Board will avoid making the mistake of "placing all their eggs in one basket" and orders for these engines should be distributed throughout the shipbuilding and marine-engineering industry of the United States. At the present time there are excellent domestic facilities available for building successful designs of marine Diesel engines which were closed during the war, and I understand that several of America's oldest and largest steel shipbuilders now are ready to accept such orders.

It is in the best interests of the nation that this be done without further delay if the Government decides to continue with the construction of the Merchant Marine. If we should abandon our proposed great Merchant Marine, America will become a laughing stock for the world, for, have we not blazoned far and wide our intention to have the greatest Mercantile Marine in existence. A successful steam-propelled fleet is out of the question; therefore, the Shipping Board should build a large and economical oil-

engined motorship fleet, and sell them at reduced cost to private shipowners.

Outside of Great Britain, the largest motorships now are being built in Sweden, Norway, Holland, Denmark, and Japan. Some of those under construction or on order in Denmark are of 17,000 tons displacement, 12,470 tons capacity, of 6,000 indicated-horsepower and 12½ knots speed. The motors are of the four-cycle Diesel type, and each will have six-cylinders 740 mm. bore by 1,150 mm. stroke, and will develop 3,000 i.h.p. at 115 r.p.m. Two engines will be installed per ship. Some of these vessels may be made smaller, and so have their speed increased to 15 knots.

I now follow with a list of the leading Diesel engine builders of the world, excluding the Central Powers. Altogether there are 86 concerns.

42 are building the four-cycle type.

33 are building the two-cycle type.

8 are building both types.

Information as to what type 3 firms are building is not available to me at the moment.

At least a dozen of the companies on this list

have done very little in the way of actual commercial constructions; but, peace conditions now clears the way for them to go ahead. Others have done a little work, and have suspended or abandoned further development. Several have just made a start, but at least fifty of the firms on this list have accomplished considerable naval or mercantile marine Diesel-engine construction. There also are several Japanese companies whose names are omitted. Among other American shipbuilding companies likely to start the construction of Diesel engines and motorships in the near future are the Ames Shipbuilding & Dry Dock Co. of Seattle, Wash.; Skinner & Eddy Corp. of Seattle, Wash.; the Federal Shipbuilding Co. of Newark N. J.; and the American Shipbuilding Co. of Cleveland, O.

The two-cycle Sulzer engine and the four-cycle Werpsoor engine are being built by more firms than any other designs, namely, eleven and ten companies, respectively. This is due to the large number of constructional licenses which both companies have sold.

In addition to these Diesel engine builders, there

are nearly 150 engineering concerns constructing surface-ignition or the so-called "semi-Diesel" type marine heavy-oil engines, practically all of which operate on the two-cycle principle.

In conclusion, I will refer to the operation of the first two ocean-going Diesel-driven full-powered steel motorships. Although both were experimental ships, their performances are better than those of many modern steamships.

The Tanker "Vulcanus," placed in service in 1910, up to a recent date had logged 252,000 nautical miles at an average speed of 7 knots. As she is only of 1,215 tons deadweight-capacity, of 500 b.h.p., and designed for a maximum speed of but 8 knots, this is a splendid showing for a pioneer motorship.

The other veteran motorship is the "Selandia" placed in service early in 1912. She is of 7,500 tons capacity and of 2,750 i.h.p. and with a designed speed of 10½ to 11 knots. To date she has logged 327,737 nautical miles at an average speed of 10.47 knots. During that time she consumed 11,667 tons of fuel-oil and 59 tons of lubricating-oil. Her total sea-time was 31,600 hrs.

In view of the performances of these two early motorships, which in reality were experiments, I cannot refrain from asking—Why has America waited so long?

[Editorial Note.—Other papers were read at the meeting, but the same are not available to us at the time of going to press, so we will deal with them in our next issue.—Editor.]

DUTCH MOTORSHIPS

There are registered at Rotterdam, Holland, no fewer than 35 motor-schooners, out of a total of 41 motor-schooners of 12,332 tons owned by Dutch shipowners. In addition, Holland possessed 470 motorships and steamships, totalling 1,423,412 gross tons, at the close of 1918.

EAST ASIATIC COMPANY'S TRAINING MOTORSHIP

Before the war the East Asiatic Company ordered a 3,500 tons steel motor-auxiliary five-masted sailing-ship from Ramage & Ferguson of Leith, Scotland, for the purpose of training engineers and officers. This vessel now will be completed and a six-cylinder 500 b.h.p. Burmeister & Wain Diesel engine installed. It is non-reversible and a clutch is fitted between the engine and propeller-shaft.

BOOKS ON MARINE DIESEL ENGINES

In our last issue we inserted an advertisement offering for sale a number of books on Diesel Engines by Mortimer Rose. Within three days of this advertisement appearing we sold the first 25 copies and we have on hand many additional orders for these books, which will be mailed as soon as we receive an additional supply from Great Britain.

We have just received from Paris a copy of a book on the operation of Diesel engines, which probably contains more detailed drawings on Sulzer, Fiat, and Polar engines than any previously published. To engineers that can read French, we highly recommend this book. The engines which are dealt with are installed in gun-boats of the French Navy. The surface-ignition engines of the Auxiliaries are also dealt with.

LIBBY MAINE'S GOOD RECORD CONTINUES

The excellent record, which has been made by the wooden full-powered motorship "Libby Maine," a Pacific coast vessel built at Portland and powered with the 640 h.p. Diesel engines made by the Dow Pump & Diesel Co. of San Francisco, Cal., continues to attract the attention of shipping men interested in the performance of internal-combustion motors in large ships. Advices received at San Francisco indicate that this vessel recently arrived at Manila, and up to that time had averaged 7 knots speed on her trip both from Seattle to Honolulu and from Honolulu to Manila. By the time this goes to press, she will probably have arrived at Hong Kong.

In the eight or nine months since going into commission this vessel has covered over 25,000 nautical miles, and her speed record in crossing the Pacific indicates that she has met with no trouble or delays of any kind. This is the fourth long voyage she has made with a perfect performance to her credit, and this in view of the fact, too, that she is underpowered, having only 640 h.p. to carry 3,000 tons deadweight cargo where the usual vessel of this size has at least one thousand horsepower.

The news was circulated by unfriendly interests at San Francisco that she arrived at Honolulu with a broken crankshaft. The Dow people claim that this is absolutely untrue; that she stopped at Honolulu only one day, or just long enough to fill up her oil tanks, and proceeded on her journey without further delay.

MARINE DIESEL ENGINE BUILDERS OF THE WORLD

Name	City	Design	Type
NORWAY			
Akers Mek-Vaerksted	Christiania	Burmeister & Wain	4-cycle
Norsk Maskinindustri Aktieselskab	Christiania	Sulzer	2-cycle
A/B Bofors, Gullspang	Karlskroga	Werpsoor	4-cycle
SWEDEN			
Nya A/B Atlas Diesel Motorers	Stockholm	Polar	2 & 4-cycle
Götaaverken	Gothenburg	B. & W.	4-cycle
A/B Nobels Motorer	Stockholm	Nobels	2 & 4-cycle
BELGIUM			
Cockerill & Co.	Seraing	B. & W.	4-cycle
Carrel Freres	Ghent	Carrels	2-cycle
ITALY			
Gio Ansaldo & Co.	Genoa	Sulzer	2-cycle
Ansaldo San Giorgio	Turin & Spezia	Fiat-San Giorgio	2-cycle
Savoia Shipbuilding Co.	Cornigliana Ligure	Sulzer	2-cycle
Franco-Tosi Ltd.	Legnano	Tosi	4-cycle
Ing. P. Kind & Co.	Turin	Kind	2-cycle
Officine Insubri Motori & Costruzioni Meccaniche	Milan	Tosi, or Langham & Wolff	4-cycle
FRANCE			
Schneider & Cie.	Paris & Creusot	Schneider	2 & 4-cycle
Chantiers et Ateliers De Nazaire (Penhoet)	Paris & St. Nazaire	Werpsoor	4-cycle
Societe des Moteurs Chalaisiens	St. Etienne	Sabathe	2 & 4-cycle
Thompson Houston Co.	Paris	Tosi	4-cycle
Forges et Chantiers de la Mediterranee	La Havre	Sulzer	4-cycle
Chantiers et Augustin Normand	Havre	Normand	4-cycle
Societe et Ateliers de la Loire	Loire	Loire	4-cycle
Campagne de Construction Meccanique Procides Sulzer	Paris	Sulzer	2-cycle
Weyher & Richemond	Paris	Werpsoor	4-cycle
Duiardin et Cie.	Lille	Werpsoor	4-cycle
Stabilimenti Delauney Belleville	St. Denis on Seine	Delauney-Belleville	4-cycle
HOLLAND			
Werpsoor Engineering Works	Amsterdam	Werpsoor	4-cycle
Werf Gusto, Firma A. F. Smulders	Scheidam	Gusto	4-cycle
DENMARK			
Burmeister & Wain	Copenhagen	B. & W.	4-cycle
Danish Diesel Motor Works	Holeby	Holeby	4-cycle
Hera Motorfabrik	Copenhagen	Hera	2-cycle
THE UNITED STATES OF AMERICA			
Bethlehem Steel Co.	South Bethlehem	West	2-cycle
Ingersoll-Rand Co.	New York, N. Y.	Price-Rathbun	4-cycle
Rathbun-Jones Eng. Co.	Toledo, Ohio	Price-Rathbun	4-cycle
Sterling Engine Co.	Buffalo, N. Y.	Sterling-Junkers	2-cycle
Worthington Pump & Machinery Corp.	Buffalo, N. Y.	Snow	4-cycle
Atlas Imperial Gas Engine Co.	Oakland, Cal.	Atlas	4-cycle
Midwest Engine Co.	Indianapolis, Ind.	Werpsoor & Midwest	4-cycle
Skandia-Pacific Oil Engine Co.	Oakland, Cal.	Werpsoor	4-cycle
Dow Pump & Diesel Engine Co.	Alameda, Cal.	Willans-Robinson	4-cycle
Wm. Cramp & Son Ship & Engine Co.	Phila. Pa.	Burmeister & Wain	4-cycle
McIntosh & Seymour Corp.	Auburn, N. Y.	Polar	4-cycle
Fulton Mfg. Co.	Erie, Pa.	Fulton	2-cycle
Winton Engine Works	Cleveland, Ohio	Winton	4-cycle
Wisconsin Motor Mfg. Co.	Milwaukee, Wisc.	Wisconsin-Junker	2-cycle
Nordberg Mfg. Co.	Milwaukee, Wisc.	Carrels	2-cycle
Busch-Sulzer Co.	St. Louis, Mo.	Sulzer	2 & 4-cycle
New York Shipbuilding Corp.	Camden, N. J.	Werpsoor	4-cycle
Newport News Shipbuilding & Dry Dock Co.	Newport News, Va.	Werpsoor	4-cycle
New London Ship & Engine Co.	Groton, Conn.	Nelsco	4-cycle
Southwark Foundry & Machine Co.	Phila., Pa.	Southwark-Harris	2-cycle
James Craig Engine Works	Jersey City, N. J.	Craig	4-cycle
Gas Engine & Power Co.	Morris Heights, N. J.	Speedway	2-cycle
Manitowoc Shipbuilding Co.	Manitowoc, Wis.	Tosi	4-cycle
SWITZERLAND			
Sulzer Freres	Winterthur	Sulzer	2-cycle
JAPAN			
Japanese Navy Dept.	Tokyo	Sulzer	2-cycle
Kawasaki Dockyard	Kiobe	Ansaldo-Fiat	2-cycle
RUSSIA			
Kolomna Mashinenfabrik	Golutwin	Sulzer & Kolomna	2 & 4-cycle
Nobel Maschinenfabrik	Petrograd	Nobel	2 & 4-cycle
Soromow Engineering Works	Soromow	Sulzer	2-cycle
SPAIN			
Sociedad Espanola de Construccione Metalicas	Madrid & Balboa	Sulzer	2-cycle
GREAT BRITAIN			
Cammell Laird & Co.	Birkenhead	Fullagar	2-cycle
*North British Diesel Engine Co.	Glasgow	—	4-cycle
Clyde Shipbuilding & Engr. Co.	Govan, Glasgow	Carrels	2-cycle
Harland & Wolff Diesel Dept.	Glasgow	Burmeister & Wain	4-cycle
Wm. Doxford & Sons (Northumberland Shipbldg. Co. Ltd.)	Sunderland	Junkers	2-cycle
Wallsend Slipway	Wallsend-on-Tyne	—	Solid-injection
North Eastern Marine Engr. Co.	Wallsend-on-Tyne	Werpsoor	4-cycle
John I. Thornycroft & Co.	London	Carrels	2-cycle
Wm. Denny Bros. & Co. Ltd.	Dumbarton	Sulzer	2-cycle
J. Samuel White & Co.	East Cowes	White M. A. N.	2-cycle
Vickers Limited	Barrow-in-Furness	Vickers	4-cycle
Mirrlees, Bickerton & Day	Stockton-on-Tees	Mirrlees	4-cycle
Willans, Robinson & Co.	Rugby	Willans	4-cycle
Yarrows Limited	Scottstown	M. A. N.	2-cycle
Fairfield Shipbldg. & Engr. Co.	Port Glasgow	M. A. N.	2-cycle
Scotts Shipbldg. & Engr. Co.	Greenock	Ansaldo-Fiat	2-cycle
Alex. Stephen & Sons	Linthouse Glasgow	—	—
Sir W. G. Armstrong Whitworth & Co.	Newcastle-on-Tyne	Armstrong-Whitworth	2 & 4-cycle
Richardsons Westgarth	Middlesborough	Carrels	2-cycle
Wm. Beardmore & Co. Ltd.	Dalmuir	Beardmore & Tosi	4-cycle
Swan, Hunter & Wigham Richardsons Ltd.	Newcastle-on-Tyne	Neptune & Polar	2-cycle
Palmer's Shipbuilding & Engineering Co.	Jarrow-on-Tyne	—	—
Barclay, Curle & Co.	Glasgow	Burmeister & Wain	4-cycle
Norris, Henty & Gardners Ltd.	Paticroft	Gardner	4-cycle
Union Ship Engineering Co. Ltd.	Montrose	—	4-cycle
Ruston & Hornsby	Lincoln	Nelsco†	4-cycle

*Originally formed to build Krupp engines.

†Several other British engineering companies also built the Nelsco (American) marine Diesel engine during the war.

Seven Years Operation of the First Large Merchant Motorship

The M.S. "Selandia" Has Cruised 327,737 Nautical-Miles at an Average Speed of 10.47 Knots



Chief-Engineer A. Rasmussen of the motorship "Selandia"

WHEN the East Asiatic Company placed their first large Diesel-driven ocean-going motorship in service in February, 1912, many shipowners slowly shook their heads, looked wise, and considered the "Selandia" to be an interesting, but a very expensive, experiment that would die a natural death. Today this veteran motor vessel is in regular service making better speed and with better fuel economy, also more consistent running, than during the days she made her maiden voyage.

Of course, the "Selandia" has had her troubles, so repairs and alterations have had to be made at various times. It would have been extraordinary if such had not been needed, considering the great engineering advance she represented at the time of her construction, when the largest ocean-going, full-powered, Diesel-driven, motorship afloat was the "Vulcanus," a little tanker of 1,250 tons dwt, and of 500 horse-power. Nevertheless, the "Selandia" is a successful ship and has continually been a good profit earner.

After seven years operation between Europe and the Far East, and between the Pacific Coast of the U. S. A. and the Southern Oceans, she paid her first visit to New York in February last, carrying a most distinguished passenger, the Hon. Francis Burton Harrison, Governor-General of the Philippine Islands, and averaging 221 nautical-miles on some days en route. Governor Harrison's comments on the "Selandia" were outlined in a letter on page 23 of our issue of March, 1919.

We are enabled to give some figures of each voyage she has completed since her trial trip, which reminds us that our previous visit to this ship was at London when she was on her maiden voyage to Siam in 1912. The following data was taken from her log-book, and certainly made a remarkable showing that no steamship of similar overall dimensions and designed speed could equal. On the voyage to Bangkok, Siam, she generally was fully loaded from Antwerp to Singapore. All figures include time and consumption in port, except those of the running time, which represent the time at sea.

From the above it will be seen that the "Selandia" has covered 327,737 nautical-miles on a total fuel-consumption of 11,667 tons (or 81,739 barrels) of fuel-oil, and for practically the entire time she was fully loaded both out and home. As she has been bunkering where oil is cheap, her seven years fuel-bill could not have exceeded \$102,174.00, assuming that the fuel averaged \$1.25 per barrel over that period.

As in addition to fuel, water and stores, she carries 6,400 net-tons of cargo, the fuel cost per mile is \$0.31. In other words the fuel-bill per cargo-ton-mile works out at \$0.00048, or less than half-a-mill.

The "Selandia" has the following dimensions:

Displacement 9,800 tons
Dead-Weight-Capacity 7,400 tons
Bunker Capacity 1,000 tons
Actual Cargo-Capacity 6,400 tons
Gross Tonnage 4,900 tons
Net Tonnage 3,200 tons
Length O. A. 370 ft.
Length B. P. 370 ft.
Breadth 53 ft.
Depth 30 ft.
Draught 23 ft. 6 in.
Power (with auxiliaries) 2,400 I.H.P.
Revolution Speed 125 R.P.M.
Power per Engine 1,120 I.H.P.

Designed Engine Power 1,500 I.H.P. at 140 R.P.M.
Propellers (each) 11 ft. dia. by 9 ft. 3 ins., with 42 sq. ft. area. Bronze construction
Cylinder Bore and Stroke 20 3/4 ins. by 28 3/4 ins.
Engine Room Staff Chief-Engineer, 2nd, 3rd and 4th Engineers (no 1st Engineer); 4 Union-Engineers; 4 Greasers; 1 Electrician. Total, 13 men.

Daily Fuel-Consumption 8 1/2 tons Summer
Consumption for I.H.P. hour 140 to 150 grammes
Builders of Hull and Engines Burmeister and Wain

Chief-Engineer A. Rasmussen, who has been with the ship for three years, advises us that during that time, no cylinder-heads have cracked, but there have been some pistons cracked. The longest non-stop run made was of 35 days and nights, namely from Singapore to London, via South Africa. Second-Engineer Axel Frandsen has been with the "Selandia" since she left the builder's yard on her trial run.

On the last voyage she took 885 tons of fuel-oil aboard at San Francisco, sailed to Sydney, New South Wales, thence to Manila, P. I., to Panama via the Canal to Kingston, Jamaica, finally to New York, where she arrived with 40 tons of oil in her bunkers, or sufficient for another five days at full speed. In the Canal zone she passed some steam-

ships that had been waiting four days for coal. At times the "Selandia" averages 12 knots loaded.

While the "Selandia" engines have oil-cooled pistons, her engineers prefer water-cooling, as oil leaves too much carbon deposit. The lubricating-oils used have been Vacuum D. T. E. and R. R., but the load just shipped was Veritas supplied by a company in Philadelphia.

The highest power yet recorded while on a regular voyage was 1,174 I.H.P. per engine at 129 R.P.M. on fuel-consumption of 144.3 grammes per I.H.P. hour. On the day that she averaged 268 nautical miles her engines averaged 125.4 rev. per minute and the oil consumed for the distance was 60 barrels. This was during her 14th voyage, illustrating that the engines became better after many years' service. The original mean-indicated pressure of the engine was 6.3 KG per sq. cm., but this has been reduced to 6.2 KG. Regarding the lubricating-oil consumption in the table, this included engine-oil, cylinder-oil and auxiliary compressor-oil.

The motorship "Selandia" recently left for England under charter through the France and Canada Steamship Corporation, of 120 Broadway, New York City.

No. of Voyage	Route	Date	Distance in sea-miles	Running-time in hours	Total fuel consumption in tons	Total Lub-oil consumption in kilos	Average speed in knots
1	Copenhagen to Bangkok, Siam, via Suez, and return.	Feb. 17, 1912 to July 1, 1912	21,219	1,942	728 1/4	3,678	10.92
2	Same as Voy. No. 1	July 2 to Nov. 19, 1912	20,775	1,876	722	4,789	11.07
3	Same as Voy. No. 1	Nov. 19 to Ap. 11, 1913	20,707	1,944	678 3/4	2,836	10.65
4	Same as Voy. No. 1	Ap. 19 to Aug. 27, 1913	21,032	1,945	751	2,184	10.81
5	Same as Voy. No. 1	Aug. 28 to Jan. 13, 1914	20,792	1,914	739	2,419	10.85
6	Same as Voy. No. 1	Jan. 14 to June 24, 1914	21,170	1,880	745	2,776	11.26
7	Same as Voy. No. 1	June 25 to Nov. 13, 1914	22,135	1,929	747	3,776	11.47
8	Same as Voy. No. 1	Nov. 14 to May 5, 1915	22,912	2,057	780	3,826	10.65
9	Copenhagen to W. coast of S. America, via Panama Canal, via Valparaiso, via West Indies, and return.	May 6 to Oct. 13, 1915	17,875	1,689	697	3,967	10.53
From October 14th to November 16th, 1915, the "Selandia" was in Copenhagen undergoing alterations including changing the fuel-pump system. Originally she had a pair of pumps for each set of four-cylinders. Now she has a separate pump for each cylinder.							
10	Copenhagen to Valparaiso, and return.	Nov. 16 to June 14, 1916	22,763	2,557	859	5,230	8.90
From June 14th to Aug. 13th, 1916, the "Selandia" was in Copenhagen for new air-compressors. The old compressors had a single-stage, so their work was too severe. Three-stage compressors were substituted. Compressor trouble on the last voyage spoilt her speed record.							
11	Copenhagen to Bangkok, via South Africa, and return.	Dec. 24 to June 28, 1916	23,951	2,267	836	4,448	10.57
At this time the working-cylinders of the engine were measured, and the wear was found to vary from 1 1/2 mm. to 2 mm. at the upper ends, for the 5 1/4 years running. The trunk-pistons were discarded in favor of short-pistons, as when hot the long type of pistons stopped the engine.							
12	Copenhagen to Bangkok, via Suez Canal and return.	Aug. 13 to Dec. 23, 1916	19,912	1,815	663	4,560	10.97
13	Copenhagen to San Francisco, thence to Orient including Kobe, Shanghai, Hong Kong, Singapore, and back to San Francisco.	June 29 to Dec. 31, 1917	25,143	2,475	888	5,148	10.16
14	San Francisco to Kobe, Japan, and July 31, 1918 Shanghai, and back to San Francisco, thence to Sydney, Australia, and back to San Francisco.	Jan. 1st to July 31, 1918	24,761	2,533	968	4,373	9.77
On one day during this voyage she covered 268 nautical miles at 125.4 average revs. per minute, on a 24 hours fuel-consumption of 8.653 tons, and with full load of cargo.							
15	San Francisco to Sydney, Australia, Feb. 3, 1919 thence to Manila, P. I., Kingston, Jamaica, and New York.	Aug. 1st to Feb. 3, 1919	22,590	2,477	865	5,072	9.17
Total 327,737 sea-miles 31,300 hours 11,667 tons 59,082 kilos 10.47 knots (or 59 tons)							

Table showing operation of motorship "Selandia" from maiden voyage to present day

American Shipyard Will Build 12,000 Ton Oil-Fired Steamships At \$140.00 Per D. W. Ton

Shipping Board Official Says 10,000 Ton Ships Will Carry 500 Additional Tons On 7,000 Miles Voyage If Diesel Driven

Proposals to build oil-fired, steam-driven, steel cargo-vessels of 12,000 tons d.w. each for \$149.00 per ton have been made to the U. S. Shipping Board by the Submarine Boat Corporation of N. J. These vessels are to be propelled by reciprocating steam-engines of 5,000 H.P. or geared-turbines of 4,200 Shaft H.P., with oil fired Scotch boilers. Their dimensions will be as follows:

Dead-weight-capacity	12,000 tons
Type	Shelter deck
Length B.P.	473 feet
Moulded breadth	62 feet
Draught	28½ feet
Power	5,000 I. H. P.
Radius	13,000 sea miles
Speed (loaded)	12 knots

They are from designs by Mr. Theodore E. Ferris and Mr. Frank E. Kirby.

In the comments on this offer issued by the U. S. Shipping Board, Mr. A. P. Allen, Chief Engineer of the Department of Construction and

Repair, points out that a 10,000 ton Diesel-driven ship on a 7,000 mile voyage will carry 540 tons more cargo than an oil-fired steamer, or an equivalent of \$27,000.00 in extra freight receipts. The Diesel motorship, he says, will carry 1,600 tons more than a coal-burning steamship, or an equivalent to \$67,000.00 per voyage, apart from the economy of the smaller fuel bill.

Mr. Allen gives the fuel consumptions for a 7,000 mile voyage as follows:

Diesel-engines	1,600 tons
Steam-engines (oil-fired)	800 tons
Steam-engines (coal-burning)	260 tons

In view of the Shipping Board's figures, we trust that the order for the above ships will be placed, but that Mr. Hurley will insist upon Diesel engines being installed. If the builders cannot furnish the Diesel engines there are several capable domestic engineering concerns who would be glad to accept the order.

Wooden Motorships and the Teredo Worm—The Use of Copper Paint

Because of the failure of the builders and owners to copper sheath, or properly copper-paint the bottoms of the hulls, of some of the wooden motorships and motor-auxiliary sailing vessels recently built on the Pacific and Atlantic Coasts, a number have suffered from severe damage by the destructive teredo worm, which is to be found in all Southern and tropical waters. In some cases the oil-engine propelling machinery of wooden auxiliary vessels has been seriously damaged thro' salt-water getting in the engine-room whilst the vessels have been in the harbor. We suggest that manufacturers of copper-paint make known the value of their product in this respect to shipowners and shipbuilders thro' the medium of our publicity columns.

At the time the teredo attaches itself to the outside of the ship, says the "Sisco Periscope," it is of diminutive proportions. The hole left by its entrance is so small that a casual inspection of the hull may fail to reveal its presence. But their growth is rapid, assuming at maturity lengths of from a few inches to three feet, according to the species to which it belongs. They live in long holes, which they burrow in the wood.

So great is the number of these worms in a small area that the wood so infested has often a spongelike appearance. A flimsy sheathing of wood divides their tunnels. They generally work in the direction of the grain, and when the burrow of a neighbor is reached the course is altered. A bisecting burrow is never found.

The animal throws off a substance with which it lines its burrow. The head is somewhat larger than the rest of the body and bears a pair of shell-like valves. Through the aperture between these it protrudes a long sucker called a foot. Whether the teredo works its destruction by this

or by other means the scientists have been unable to discover. One Olsen argued in the year 1826 that it bored by means of its shells, fixing itself by the surface of the foot, which it uses as a sucker, and then rasping the wood with the rough front edges of the shell valves. Since then many theories have been advanced, but none has been generally accepted.

The animal was known to the ancients and is mentioned by Theophrastus, Pliny, and Ovid. In 1773 it was discovered that the wooden dikes of Holland were being destroyed by the ship worm, and that the country was in danger of a flood.

The teredo does not exist in New York waters, owing to the sewage and acid deposits in the rivers, but infests waters from Seattle, Wash., to Cape Fair Weather, North Carolina.

Copper sheathing is the best protection. In lieu of this a coat of copper paint every six months is effective. Another preventive is soaking the wood with creosote, while coal tar and silicate of lime are also used. A method of destroying the pest is to allow the boat to stay in dry dock for a few weeks. When the teredo exhausts its supply of water it dies. In New York waters boats are often anchored near factories that discharge sulphuric acids into the stream. This method has proved successful.

AN ADDITION TO REX WADMAN'S ORGANIZATION

Frank R. Farnham, formerly sales and advertising counsel of Hollister, White & Company, and their allied interests, has joined the organization of Rex Wadman, Inc., technical advertising, as Vice-President. Mr. Farnham was formerly sales and advertising manager of Gibson Hollister Manufacturing Company, previously being connected with the Service Department of McGraw-Hill Company.

VICE PRESIDENT J. L. ACKERSON TO HAVE CHARGE OF CONSTRUCTION OF GOVERNMENT'S MERCHANT SHIPS

Important changes in the personnel of the Emergency Fleet Corporation have been announced by Edward N. Hurley, Chairman of the United States Shipping Board and President of the Emergency Fleet Corporation. Charles Piez, who succeeded Charles M. Schwab as Director General, tendered his resignation several weeks ago. Upon his retirement on May 1, Naval Constructor J. L. Ackerson, who has been one of the Vice-Presidents of the Fleet Corporation, takes full charge of ship construction.

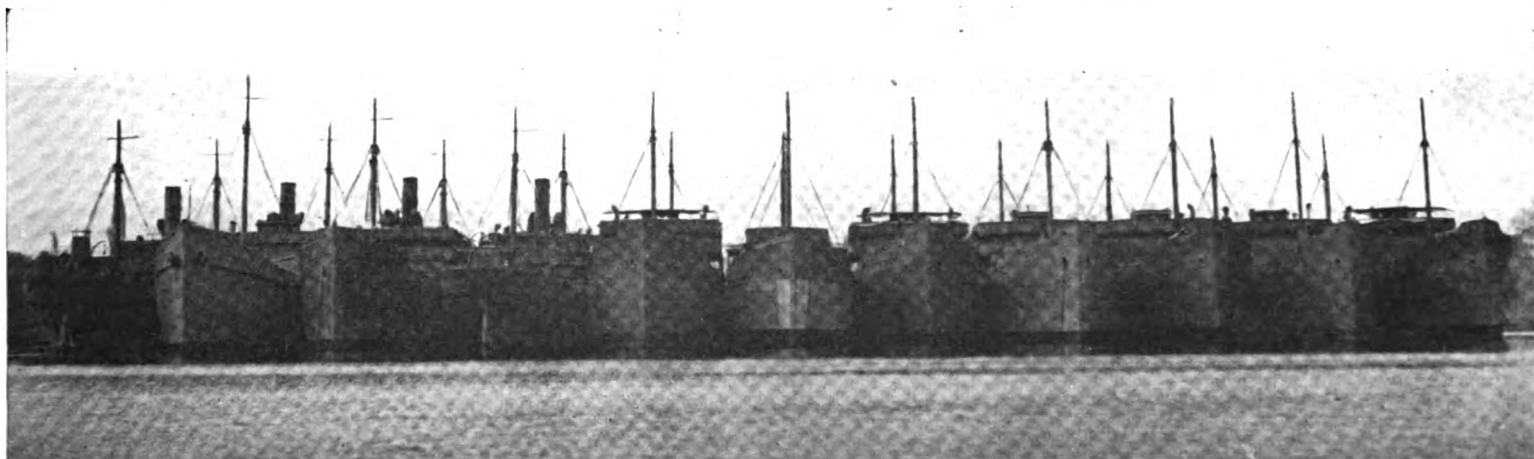
Mr. Ackerson is a practical shipbuilder and is strongly in favor of oil-engined motorships for merchant work. Born in Michigan in 1881, he entered the Naval Academy in 1897. He was graduated in 1901 and spent the following two years at sea as a midshipman, being assigned to both the East and West Coasts. In 1903 Mr. Ackerson was selected for the construction corps and was sent to the Massachusetts Institute of Technology for a post-graduate course in naval architecture. He graduated in 1906 with the degree of Master of Science, and was detailed to the New York Navy Yard. He later became fleet naval instructor under Admiral Schroeder, and was an aide on Admiral Schroeder's Staff.

After about two years more at sea, Mr. Ackerson was sent to Washington and assigned to the design branch of the Bureau of Construction and Repair, where he remained for five years. During the period that he was assigned to the design branch, Mr. Ackerson was superintendent of construction at the Maryland Steel Works, Baltimore.

In 1915 he was ordered to the Mare Island Navy Yard, where he was assigned to duty as superintendent of new construction, this including work on battleships, destroyers and colliers. In June, 1917, he was ordered back to the Bureau of Construction and Repair for special temporary duty in the design branch. In August, 1917, he went with Admiral Capps as aide when that officer joined the Fleet Corporation as general manager. After Admiral Capps left the Fleet Corporation, Mr. Ackerson remained as aide to Mr. Piez. He next became assistant to Mr. Schwab and later was appointed Vice-President of the Fleet Corporation. He was loaned to the Emergency Fleet Corporation as a commissioned officer on active duty. As Naval-Constructor he holds the rank of Commander. We may mention that Homer L. Ferguson, President of the Newport News Shipbuilding Company, recently went on record as saying that, in his opinion, Commander Ackerson is one of the ablest shipbuilders in America.

PERSONAL

Shipowners who may be desirous of obtaining the services in a consulting capacity of an expert Naval Architect and Marine Engineer will be interested to know that Mr. Arthur F. Johnson has returned to civil business. During the war Mr. Johnson has been with the Transport Service of the U. S. War Department in the capacity of Assistant Marine Superintendent. He is now prepared to act as consultant in the behalf of shipowners and shipbuilders, in fact is the consulting engineer to the Fabricated Ship Corporation of Milwaukee. Mr. Johnson's address is 535 Cass Street, Milwaukee, Wisconsin, and will be glad to hear from both old and new friends and business associates.



Many of these idle wooden-ships can be turned into profitable cargo-carriers if fitted with oil engines; meanwhile the millions of dollars invested in these vessels are a dead investment. They are needed in the coastwise trade, including Alaska. The vessels illustrated are moored in Lake Union, Seattle, Wash. On the Columbia river there are about 40 more. (See our editorial leader.)

Engine-Room Auxiliary Machinery for Motorships

By L. B. JACKSON

(Member A.S.M.E. Member D.E.U.A. of England)

[This article is published with the permission of The Texas Company, by whom the auxiliaries described were acquired and installed. The author has requested us to state that he has not assumed to make comparisons as between the product of various manufacturers. It has been necessary for him to refer to the product of various manufacturers, because of such product having actually entered into the installations, which are the basis for this article.—EDITOR.]

THAT the era of successful Diesel-engine propelled vessels has arrived is an indisputable fact, yet to claim that all motorships are an unqualified success would be as unreasonable as to make a similar claim for all steam turbine propelled vessels. What should be understood is that it has been proved, by actual operation of motorships, for a considerable period of time, that a properly designed and constructed Diesel engine is as reliable as the standard reciprocating marine steam-engine. The higher efficiency, greater fuel economy and consequent increased cruising radius of motorships is too well appreciated to warrant discussion in this article.

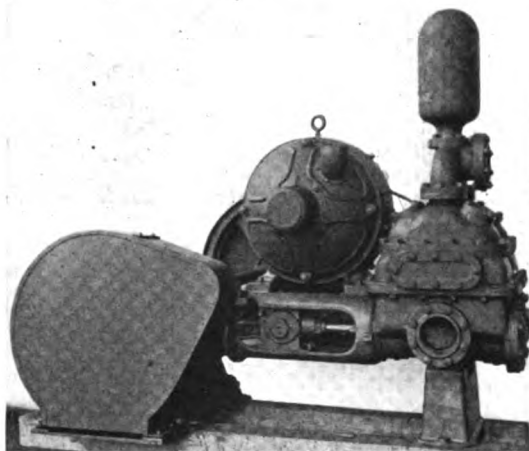
While it is true that the propelling Diesel-engine is the heart of the vessel, there are other vital parts upon the selection of which determines whether or not the vessel will be a complete success. These parts are commonly called "the auxiliaries" and include windlass, capstan, winches, steering gear, cargo or ballast pumps, electric generators and miscellaneous engine-room pumps. It is the purpose of this article to draw attention to these units and to describe and illustrate some that have already been built and thoroughly tested.

Some steamship companies, due to what they have read, seen or heard, have become convinced that the Diesel engine is worthy of a trial and have placed contracts for the engines and hull, feeling that they were ordering a thoroughly up-to-date vessel in every respect. The selection of the auxiliaries probably rests with the Superintending-Engineer who in most cases is a marine engineer who has had considerable experience with steam engines and steam auxiliaries. He is more than likely quite conservative and looks upon the vessel as a costly experiment and has serious misgivings as to its being a success. Furthermore, he knows that, although the decision to build a vessel was not his decision, "that it will be up to him" to keep the vessel in commission after it leaves the shipyard. Under these conditions it is not surprising to find that he specifies an oil-fired boiler and steam-driven auxiliaries.

He undoubtedly secures reliability, but at an unwarrantable excessive cost. Figures taken from the engineer's log of one of the newest motorships show that the fuel consumption of the donkey-boiler has amounted to approximately 42 per cent of the fuel used by the main engines. Assuming that the power developed by the main engines was 1,000 b.h.p., then the amount of oil consumed by the donkey-boiler would have produced 420 b.h.p. had it been used by the main engines. This is

expensive, but it does not insure any greater reliability.

Any experienced marine engineer will freely state that the generator of the electric set is the unit that requires the least attention. Everyone possessing any mechanical knowledge knows that there is no means of motive power which is more reliable than an electric motor. With this knowledge in their possession, why do shipowners decide



Fairbanks-Morse electrically driven piston-type cargo pumping set

to propel their vessels with internal-combustion engines and then hesitate to develop the power for their auxiliaries from the same source?

A motorship in order to be a complete success and to operate at maximum efficiency must have electrically operated auxiliaries. Furthermore, the electricity must be derived from generators driven by oil-engines. At the present time there is absolutely no other way of generating the necessary power with the same degree of reliability and fuel economy. The most outstanding advantages of this system are as follows:

- (a) Simplicity and reliability.
- (b) Fuel economy.
- (c) Elimination of deck steam piping.
- (d) Centralization of control.
- (e) Auxiliaries always ready for immediate service—no delay bleeding out condensation.
- (f) Extremely low maintenance cost and depreciation.

The cost of a donkey-boiler (there should be two, not one, if steam is used) steam generating sets, boiler and engine room piping, deck steam and exhaust piping, steam radiators for living quarters and necessary piping for same is sufficiently greater than the cost of oil engine driven generator sets and wiring of all kinds (heat and power) to offset the increased cost of electric auxiliaries over steam auxiliaries. In other words, the initial investment is practically the same whether the auxiliaries are steam or electric, and therefore low initial cost cannot be offered sincerely as an excuse for using inefficient steam-driven auxiliaries.

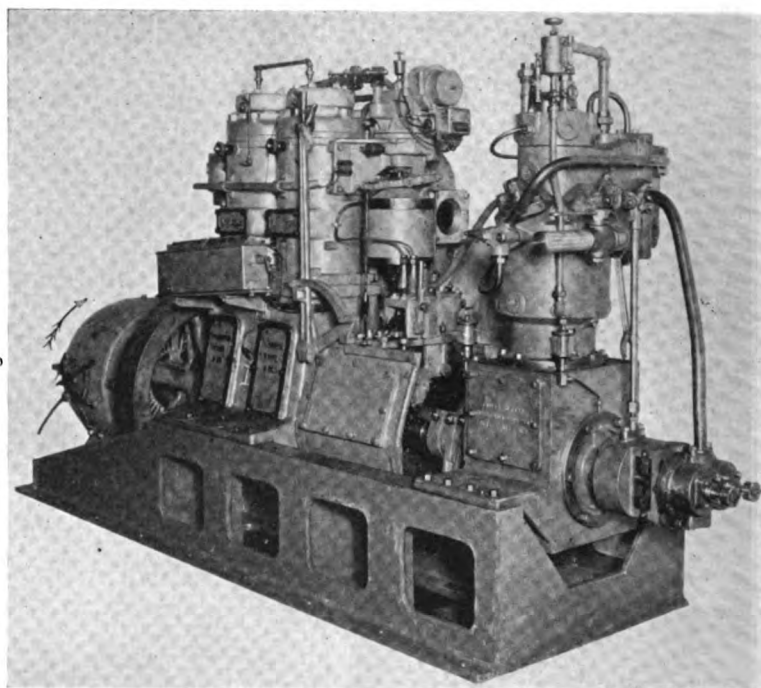
The auxiliaries described and illustrated in these pages are suitable for a tanker of about 5,000 d.w. tons. On a tanker, it is the cargo pumps that predominate, not winches, as would be the case on a general-cargo vessel. All other auxiliaries, however, would be the same on either type.

The generating set illustrated consists of a 3-cylinder, 75 b.h.p. $10\frac{1}{2} \times 12\frac{1}{2}$ in. Fairbanks-Morse surface-ignition oil-engine direct connected through a "Francke" type coupling to a 45 k.w. 250 volt c.w.

direct-current generator made by the same builders as the engine. These two units, separately, are standard and have been used very successfully for many years. The only special features, i.e., not standard, are the sub-base upon which they are mounted and the flywheel which is of increased diameter. Three of the sets are required in order to satisfactorily meet the various load conditions. The number of sets running will vary depending upon whether the vessel is discharging her cargo or is at sea, also upon the season of the year and latitude. It is, therefore, essential that these units be capable of running in multiple. Upon the test floor these machines, although only equipped with the standard marine governor, clearly demonstrated that they could be run in multiple as readily as standard steam-engine driven generators. An overload of $33\frac{1}{3}$ per cent was easily obtained and the variation in speed when load was increased instantly from no load to full load was barely perceptible. Before this test was made a duplicate engine had been tested as to reliability in a 100 ft. boat which was run from a North Atlantic port to the Gulf of Mexico, approximately 3,000 miles, without any repairs being necessary either during or at the completion of the trip.

Another illustration shows an "emergency set" or oil-engine driven compressor-generator set. The engine is a two-cylinder 30 b.h.p. $8\frac{1}{2} \times 10$ in. Fairbanks-Morse oil-engine driving a 10 k.w. 250 volt c.w. direct current generator of the same make on one end, and a $2\frac{3}{4} \times 9\frac{1}{2} \times 6$ in.—1,100 lbs. per sq. in. Craig compressor on the other end, all mounted on common sub-base.

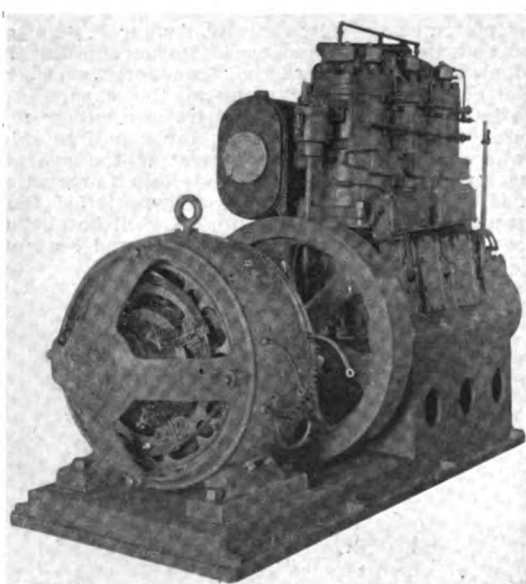
As a general rule, a compressor should not be operated by a two-cylinder engine, a three-cylinder engine being much more satisfactory. In this particular case, however, where the set will be used only for charging air bottles for injection and maneuvering after lay-up periods or for ship's lighting in port when cargo is not being handled, it was decided that the reduction in overall length warranted the use of the two-cylinder engine. The



Fairbanks-Morse emergency air-compressor-generator set

two maneuvering air-compressors which, when entering or leaving certain ports, will have to run continuously for a considerable time, are driven by three-cylinder engines of same bore and stroke. These compressors are the same as shown in illustration, excepting that as they are only required to compress air to 350-lb. pressure, the design of the head is slightly modified. No generators are connected to these two sets.

I also illustrate the cargo pumps, of which there are six. These pumps are of the horizontal duplex type with a bore of 8 in. by a stroke of 10 in., and were manufactured by Fairbanks-Morse Company. They are driven by superimposed 30 h.p. 250 volt



Fairbanks-Morse oil-engine driven electric lighting plant for ships

four times the power required, as in a motorship of this size 100 b.h.p. should cover all auxiliary requirements. To put it on a percentage basis:

(1420—1100)

1100

$\times 100 = 29\%$ more fuel is used

than is necessary. This is not only inefficient and

variable speed (50 per cent.) d.c. motors. The pumps have bronze valve decks and are brass fitted throughout. The motors are water, gas, and explosion proof. It will be noted that connections are provided in front and rear covers, by means of which fresh air (from above house over pump

pump and fuel-transfer pumps are of the same type and design, but have a bore of 5 in. by stroke of 6 in., and are driven by 5 h.p. 230 volt c.w. direct-current motors. The same applies to the fire and bilge pump. This pump is 5 x 10 in., and driven by a 20 h.p. motor. As these pumps will be located in the engine-room, they are fitted with open instead of enclosed type motors.

Another illustration depicts one of the two refrigerating sets. This is a standard 1-ton Brunswick Refrigerating Company machine driven by a 3 h.p. 230 volt, variable speed (50 per cent) Diehl motor, through a turbo-reduction gear.

Finally there is to be discussed the windlass and winches. The windlass is operated by a 25 h.p. 230 volt, c.w. direct-current Diehl motor. The winches, of which there are two, are driven by 20 h.p., 230 volt c.w. direct-current Diehl motors. The windlass, winches, capstan, and steering gear are standard deck auxiliaries, built by The Hyde Windlass Company, with motors substituted for steam engines.

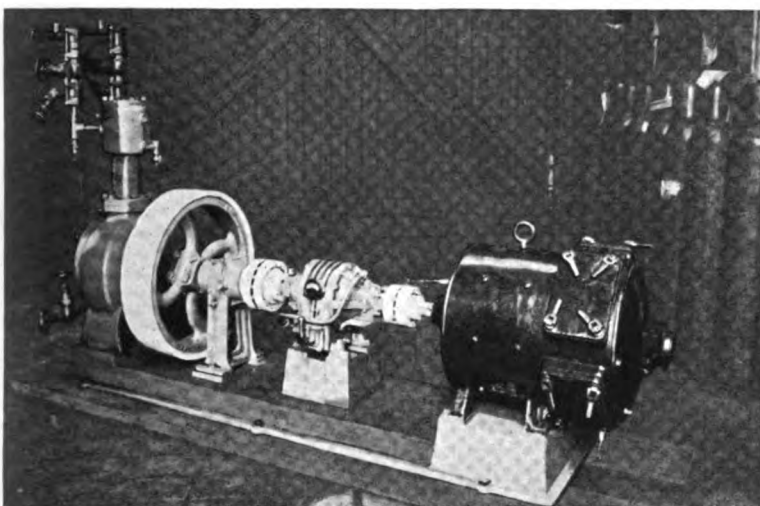
The reader of this article has undoubtedly noted that direct-current generators and motors are described throughout. It is not the purpose of the article to discuss the relative merits of d.c. and a.c. equipments. Both systems are undoubtedly perfectly feasible, and shipbuilders must decide in each case which system is best suited to their particular requirements. It is, however, certain

that for deck auxiliaries the importance of torque characteristics, and for cargo pumps the importance of speed variation, makes the d.c. the better installation.

Electric heating of quarters is accomplished by Cutler Hammer "Space" heaters varying in size from 500 watts to 2,000 watts in steps of 500. The size and number of heaters depend not only upon the size of the space to be heated, but also upon the location in the vessel. Cooking also is done by electricity. Electric hot plates and coffee urns supplant the pantry steam tables; a unique feature of the vessel being the entire absence of fire or steam.

The controlling of the various motors is novel and quite interesting, but as a description of the same would be rather lengthy, only a few details will be mentioned. All motors, whether constant or variable speed, are started by simply pushing a button, as all controllers are of the automatic or contactor type. The overload circuit breakers for all motors are on the switchboard in the dynamo room. The circuit breaker acts also as a main switch, supplanting the common knife switch and fuses. A gem-faced red glass button, mounted flush with the switchboard and just above each circuit breaker lights automatically when motor is started and remains so as long as motor is running.

By this means, the electrician in the dynamo-room can tell at any time the exact load and just what units are in operation. All controllers and resistances are chosen from Cutler Hammer standard types, the special requirements of the particular motor governing the choice in each case. It is believed that such a method of selection will prove to be better practice than the hitherto common one of using one type throughout; the latter embodying features nearly meeting all requirements for all machines without exactly meeting all the individual requirements of any one.



Electrically-driven refrigerating set

room) is drawn through the motor and discharged above deck by an exhaust fan and necessary ducts. This not only tends to make motors run cool, but also insures an air of non-explosive content enveloping the armature. Accessibility to all bearings, glands, etc., is very apparent from the illustrations.

The bilge pumps, fresh-water pump, sanitary

NETHERLANDS MOTOR GUNBOATS

When describing the British motor monitors in the April issue of "Motorship," pressure on space prevented our referring to the Netherlands shallow-draft Diesel-driven gunboats "Friso," "Gruno," and "Brinio," which were fully described in "Motorship" for February, 1918. Although we were enabled to give illustrations of their machinery no photographs of the ships were available; but we now give such illustrations, which are the first time they have been published in the United States. We reproduce their dimensions:

Displacement	540 tons
Length	172.2 ft.
Breadth	17.8 ft.
Draught	9.1 ft.
Power	1,200 to 1,500 b.h.p.
Armament	Four 4.1 in. guns and two machine guns
Armour	2 in. belt
Deck	2½ in. armour
Designed Speed	16 knots
Trial Speed (reported)	18 knots
Fuel Capacity	350 barrels

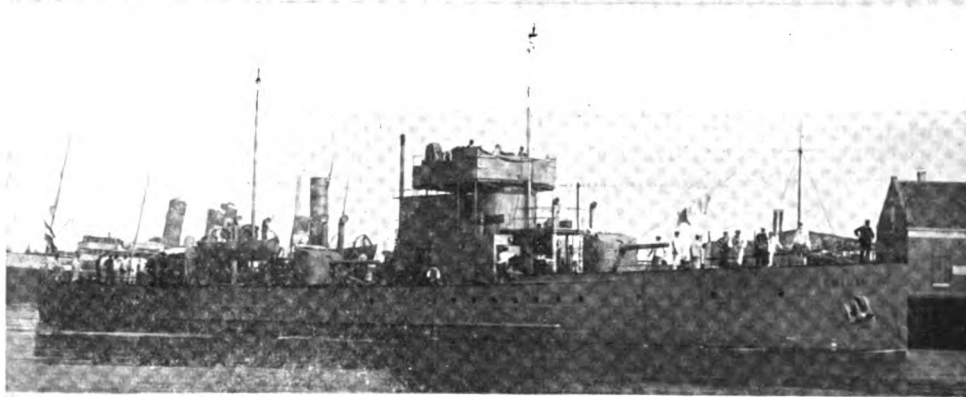
These boats were intended to have Krupp, Werkspoor, and Nürnberg Diesel engines installed, but our British naval correspondent believes that the Nürnberg (M. A. N.) engines were requisitioned by the German Government for new U-boats before delivery to the Dutch Naval authorities, and that they were replaced by an extra set of Werkspoor-Diesel engines. Of this no confirmation has reached us.

In a recent issue of a German engineering journal Professor C. Meyer of Delft, Holland, refers to the "Panzer" and "Hulfe," two Netherlands gunboats. The "Panzer" is fitted with twin six-cylinder, 310 mm. bore by 500 mm. stroke, Nürnberg (M. A. N.) two-cycle type Diesel oil-engines of 600 b.h.p. each at 275 R.P.M. on a weight of 104 lbs. per b.h.p. The "Hulfe" has a two-cylinder 320-400 b.h.p. oil-engine, 190 mm. bore by 240 mm. stroke and turns at 320-400 R.P.M. This probably is a Kromhout surface-ignition type oil-engine.

MOTORSHIP CARRIES BOILERS AS CARGO

Some time ago the six boilers of the wrecked steamer "Bear" were salvaged. They then were shipped on a new American motorship to Shanghai, by the Overseas Shipping Company, where they will be installed in new steamships building at Chinese shipyards for the U. S. Shipping Board. Each boiler weighs 46 tons. All of us know the biblical story of new patches on old garments, but here is an instance of old patches on new garments. It would have been cheaper, quicker and better for all-round results to have built some new Diesel oil-engines and sent them to China for these new vessels. The salvage and transportation feat, nevertheless, was a splendid job under the circumstances.

Three Dutch Motor Warships



The 1,200 b.h.p. Diesel-driven motor-gunboats "Gruno," "Brinio" and "Friso," of the Dutch navy

Performance of the Twin-Screw Motorship "George Washington"

A Trip to the Orient and Return—*Part 3*—Continued from March issue

By HUBERT C. VERHEY

[Engineer-in-Charge. Marine Diesel Engine Dept., U. S. Shipping Board, Emergency Fleet Corporation]

(Published by the Kind Permission of the U. S. Emergency Fleet Corporation)

THE fact that the principles on which the Diesel engine works create heat concentration, which affect the materials of the main engine parts to such an extent that overheating would cause cracking of pistons and cylinder heads, clearly shows what part the engineer takes in the satisfactory and safe operation of this type of engine.

Many failures and much criticism has been seen and heard about Diesel installations and it should be generally known that Diesel engines cannot be overloaded constantly, but there is no reason for such, as the designers should not put engines in vessels that are required to run at overloads in order to obtain contract speeds, which would surely result in breakdowns and invite much undesired criticism against this highly economic type of engine. [This has been done with many recently built American motorships—particularly auxiliary vessels.—Editor.]

The weight involved by furnishing engines at liberal dimensions in order to obtain this absolutely safe operation, is negligible, and the consumption per horse-power is not touched at all.

OVERHAUL AND REPAIRS

Leaving San Francisco everything in the engine room was in perfect running condition. The work done in the engine room in Kobe, Japan, was as follows:

A spindle of one of the injection-air bottles had to be reground.

No. 1 piston of the S. B. engine was lifted, cleaned and one new upper ring inserted.

New packing was put in for the telescopic pipes of the cooling-water for the piston.

Fuel-valve changed, and spare one put in.

Repair ball-bearing in transformer. High-pressure valves of compressor examined and cleaned.

Check-valve in overflow line of injection-air taken out and replaced.

Top plates of crankcase under cylinders cleaned. Cleaning of tank tops in tunnels.

Proceeding to Manila, P. S., the following work was done in port:

All valves of the main-compressors cleaned.

All exhaust and fuel valves taken out and the spare ones put in, in order to clean them for use the next time. One broken exhaust-valve spring was found.

her engines operate, the total lack of harmful vibration, and the readiness at which the engines respond to maneuvering are all candid facts. From full ahead to astern in six seconds is sufficient proof for the above statements.

Fuel-oil can be taken on board for one-hundred-and-twenty (120) sailing days, which fuel being stored in the double bottom and tanks between

tunnels renders all the space occupied by a steamer of the same size for coal bunkers available for cargo, while her economy has yet to be surpassed.

Furthermore, the coolness of the engine room is a very comfortable factor for the engine room personnel, for it increases their efficiency.

The comparatively small crew necessary to handle this kind of vessel is one more advantage, while the much heralded opinion that this country has not the men at present to handle these installations is far from true, as will be explained hereafter.

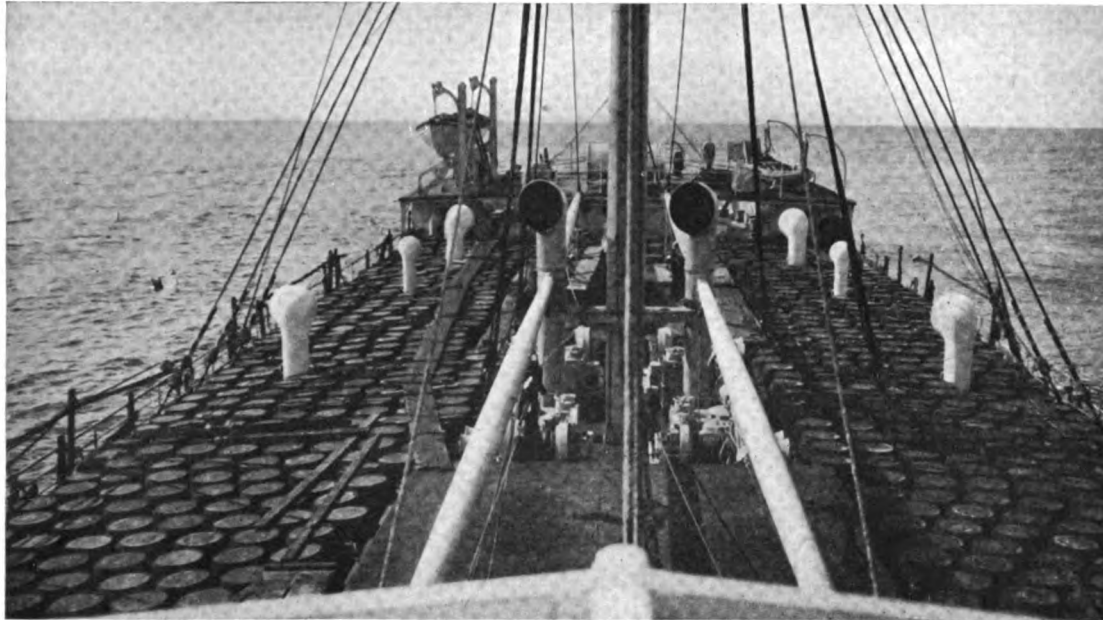
An additional distinct advantage of this class of ship is the total absence of smoke and smokestack.

The sound of the exhaust is slightly noticeable when the wind is an off direction at either

the bow or at the stern. Close to the muffler house amidships it resembles the sound of two trains pulling out of a station at one time.

And last but not least, Diesel engines in general show increased economy after they leave the test stand, due to the fact that the friction is reduced by proper running in, which holds true for all kinds of engines, but in her case the fuel-consumption is necessarily decreased and will remain constant during her whole life time under normal working conditions.

It is a fact that by proper application of the cooling agents, that the fuel-consumption will remain absolutely constant, which can not be the case with installations where heat is created to do work on pistons by means of a transmission agent, such as the case is with steam installations. Loss of grating efficiency, loss of boiler efficiency,



The "George Washington" carries a good deck-load

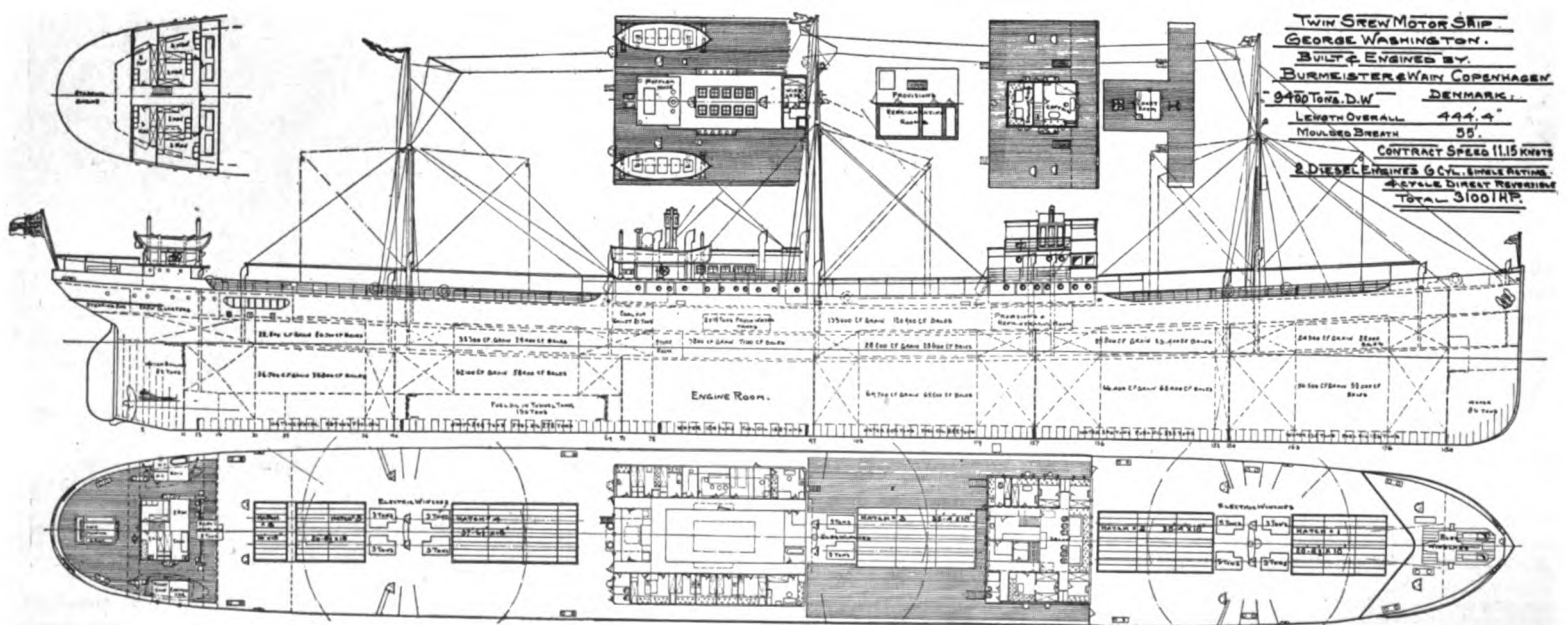
Main-bearing and crossheads examined and fitted. Cleaning of line shaft bearings.

On the return trip to San Francisco it was planned to take out all exhaust and fuel valves again, while no further repairs seemed to be necessary. A general cleaning up as usual was also planned.

Very little carbon was found in the different valves in all cases and the same can be said of the piston tops, as the combustion was perfect throughout, and at no time could the exhaust be seen, even when running at less than full load.

CONCLUSION

It can be stated that the performances of this motorship is most remarkable indeed and that the superiority above the steam propelling installations is readily visible. The smoothness at which



Plans of the m.s. "George Washington." For size of hatches see page 36, March issue

loss of heat in pipings are not found in Diesel engines.

Turning to the question of finding men to operate these engines. It may be stated that we have more men in this country who are familiar with the principles of these engines than critics believe. In addition to many men who have had actual experience with these engines and in sufficient number to warrant success as far as the above mentioned is concerned.

From actual experience the writer has seen that level-headed machinists, who could do away with prejudice against anything new in their experience, make good Diesel engineers.

There is a way open to teach the necessary number of men, the future engineers, right in the shops where the engines are built, so that they have an opportunity to see things from the bottom up, this will work no hardships on the average American trained machinist or steam engineers.

With regard to possibilities of manufacturing these engines; the writer can state, from his experience, in this country that work has been performed in the Diesel engine line that can stand the acid test as compared with European products.

The most difficult castings and the most delicate machine shop work has been turned out by some of our concerns in that line with extreme success, so that it will only be a matter for this corporation to secure the co-operation of the various manufacturers to offer us their expert advice, which surely should be rendered on patriotic grounds.

Our materials are not inferior to the ones used in Europe, in fact less troubles have been encountered in properly designed engines, that warrant this statement on the ground of personal experience.

Therefore it appears to be but a matter of rounding up our actual experts and be sure of ultimate success.

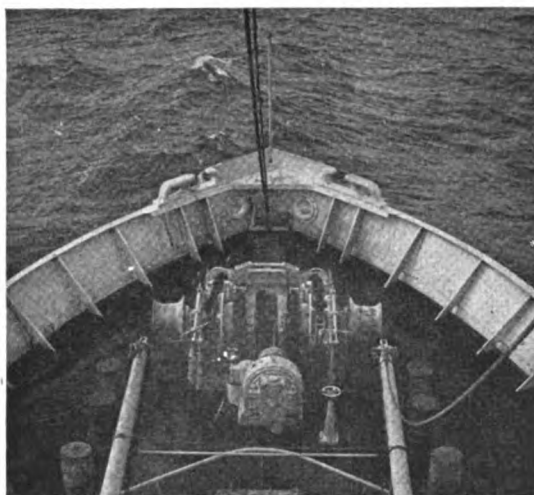
The Diesel engine is no more in a preliminary stage, as the performance of the M.S. "George Washington" show, while on the other hand other types have proven their merits with more or less success, depending on their design, and have made similar long voyages.

The secret why Europe is today in possession of successful motorships is due to the fact that ship owners of Scandinavian countries, Sweden, Norway, Denmark, and also Holland, have placed enough confidence in their various manufacturers of Diesel engines, and allowed them to build and develop these engines that are running today, thus partly taking risks, but with the final result as shown, and their foresight meant financial results to them, as no steam-driven installation can come up thus far to the economy of this type of vessel.

Switzerland and Italy have also done their share during this period of development, but not to the extent as the before named countries. The latter two countries specialized 2-cycle engines, and the others in 4-cycle engines.

During my stay in Japan, I learned that that country is also building Italian marine Diesel-engines, of the Fiat type, which clearly shows that all maritime nations are posted as the future importance of the Diesel engine. [Japan also is building Sulzer-Diesel engines.—Editor.]

Furthermore, attention is called to the fact that



The electric-driven anchor windlass of the m.s. "George Washington"

many makes of so-called semi-Diesel engines have entered the American market. They are, however, only used in smaller installations. Their economy is less than engines of the straight Diesel-type. They are working with lower pressures, which has been made a great talking point.

There was a time when poorly designed Diesel engines proved a detriment to the general adoption of these prime movers, in places where internal-combustion engines were the engines to use. For this reason engineers attempted to get away from comparative high pressures and developed this type of engine, with more or less success. In properly designed Diesel engines these high pressures can be successfully handled as proven in actual service.

When we are able to produce better materials than we have today, our pressures will rise accordingly, which will be exactly in accordance with the inventor's early ideas. These ideas were abandoned because the materials used could not stand the corresponding heat strains. As economy first of all has to be considered, it is the writers opinion that America, being at the verge of entering this field, should stick to the straight Diesel where possible.

It is also of importance to equip our vessels with engines of a successful design. At this vital time, in the interest of the ultimate success of our enterprise, we should adopt only the kind of engine for which the engineers in charge could be held directly responsible, regardless of the offers and proposals from manufacturers who claim to be able to deliver the goods but who might not be able to deliver the best obtainable.

Not enough strength can be laid on the fact that the adoption of the Diesel engine on a large scale in this country will coincide with the commercial interest of steam installation builders. This should be faced in the extreme interest of our country but no criticism should be invited which would give reason to regret the adoption of Diesel engines.

It seems unnecessary to point out that we have to face strong competition, as a young maritime nation, from all sides, after the war; but it appears

to the writer that it is possible to prepare even now during our emergency fleet building program to meet such competition, as the Diesel type of engine can absolutely be built in this country as well as in any other. As already stated, we have not to look to Europe for such men, as we have them in our midst.

HUBERT VERHEY,
Engineer-in-charge,

Marine Diesel Department.

Emergency Fleet Corporation,
Philadelphia, Pa.

FOUR-CYCLE VERSUS TWO-CYCLE

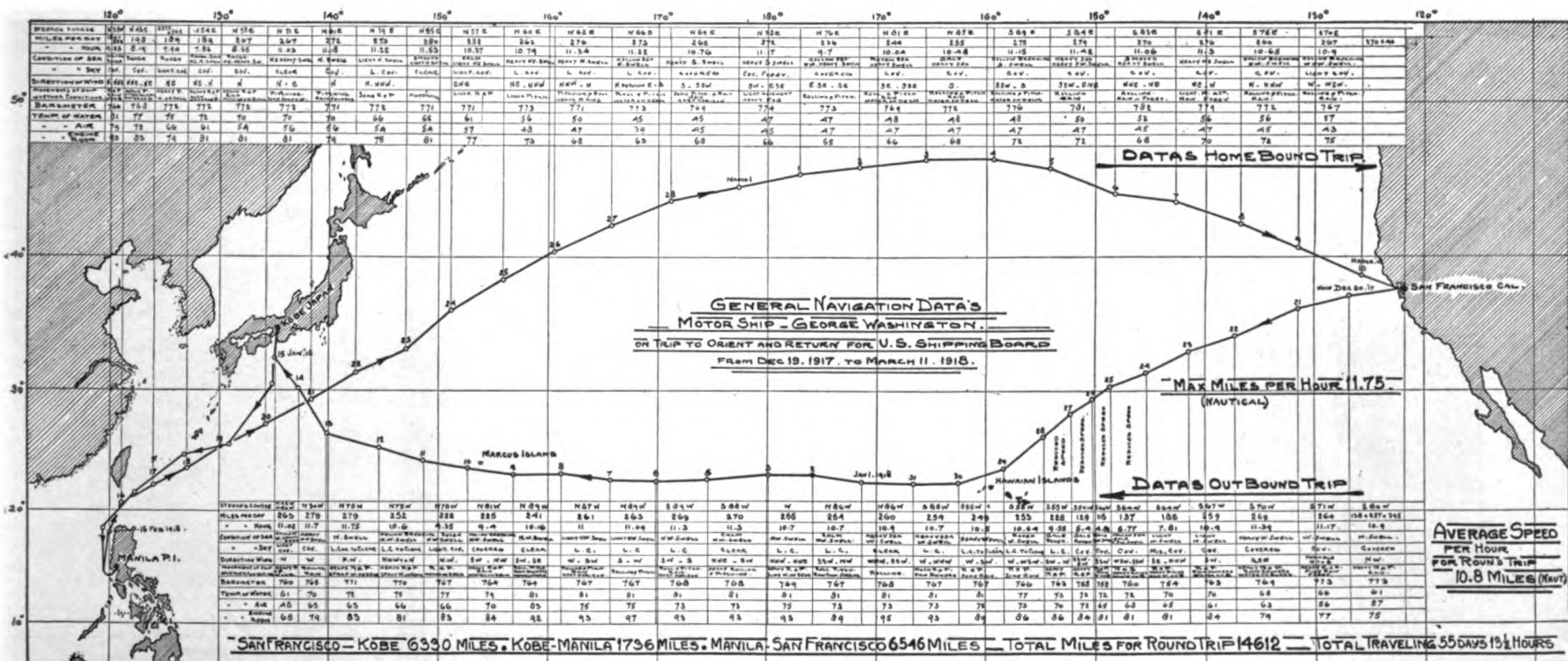
The controversy as to the relative merits of the two-stroke and the four-stroke cycle Diesel-engine still continues, and we are apparently as far as ever from a definite solution of the problem, says "Shipbuilding and Shipping Record." An interesting and somewhat novel contribution to the discussion has just been made by a writer in "L'Industria," his views being based upon the experience gained with these engines during the war, with his bias undoubtedly in favor of the four-stroke engine.

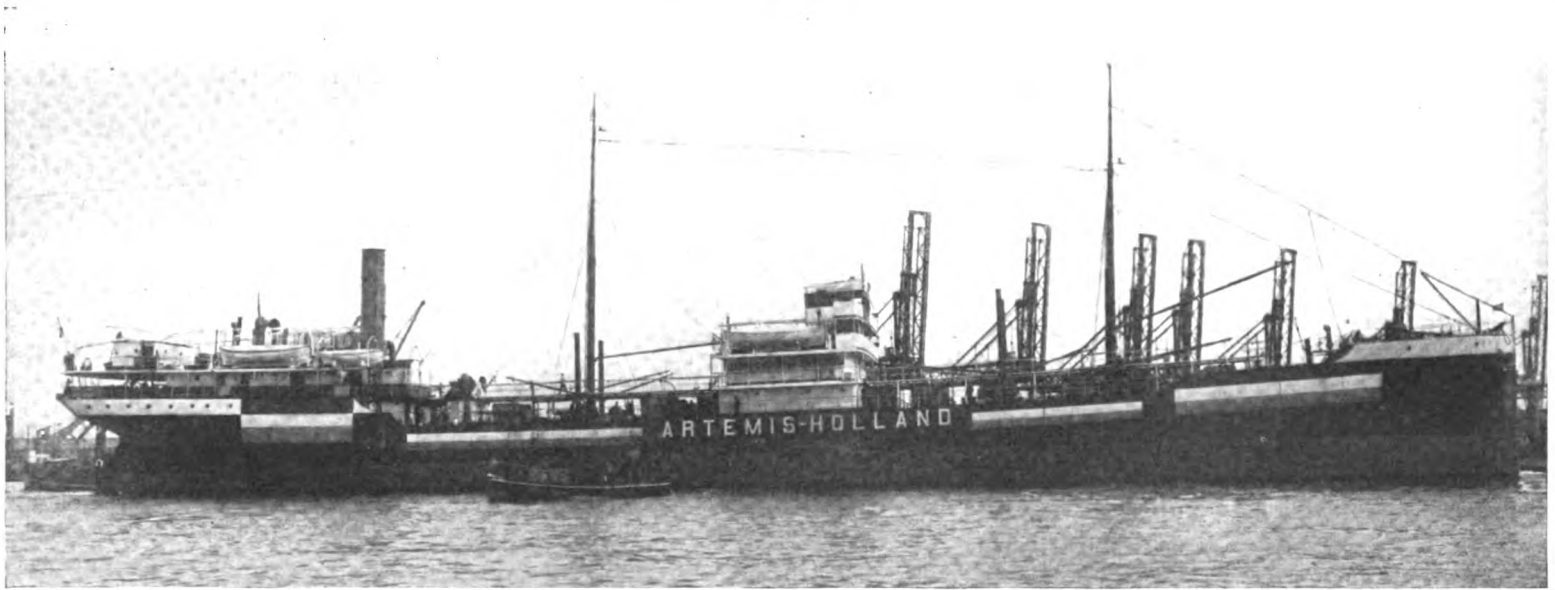
He points out that in merchant vessels the difference between the normal power and the maximum power is very small, while in submarines and in other war vessels this difference may be as one is to two, and from this standpoint the advantage rests with the two-stroke engine, since, if they are required to run at maximum load for a short time only, it is evident that they can be so proportioned as regards cylinder dimensions and fuel burned as to obtain a mean diagram pressure nearly equal to that given by a four-stroke engine. The war has shown, however, that Diesel engines have to work for extended periods at full load, and thus the advantage of the two-stroke engine disappears. Even admitting that with the mean pressure diagram it is possible to attain a value 30 per cent. below that of the four-stroke engine, and that the two-stroke engine may take up less space and be lighter than the four-stroke, it must be recognized that the two-stroke consumes a larger quantity of fuel per horse-power-hour. There is, however, the further advantage in favor of the two-stroke engine when used on vessels, that it is easier to reverse and easier to work, although, in the opinion of the writer, this apparent advantage will be outweighed when designers devote their attention to the four-stroke engine that it deserves.

TEN MOTOR AUXILIARIES FOR BRITISH ADMIRALTY

It is reported that ten wooden motor-auxiliaries are under construction at the yard of the St. John Shipbuilding Co., Courtenay Bay, New Brunswick, Canada, for the British Admiralty. Diesel engines are being installed.

"Motorship" learns with deep regret of the death of Mr. William H. Putnam, Treasurer of the Madison-Kipp Corporation of Madison, Wisc.





The oil-carrying motorship "Artemis," owned by Royal Dutch-Shell interests and propelled by two 1,100 I.H.P. Werkspoor-Diesel engines

A Great Oil Company and Its Motorship Transportation Service

Operations of Some of the Royal Dutch-Shell Diesel-Driven Tankers—The Importance of the Oil-Engine for the Carrying of Oil-Cargoes

OUTSIDE of the Standard Oil interests there has been but little inclination on the part of the leading independent oil companies of America to display practical interest in the development of the oil-engined motorship, although the successful establishment of this class of cargo-carrier means everything to the placing of the U. S. merchant marine on a sound footing. However, lately the Texas Company has shown that they realize that it is largely up to the oil companies to encourage shipowners to enter into the construction of motor vessels by leading the way with oil-engined craft of their own. Recently they have built several small Diesel-driven boats and are just preparing to lay down some large full-powered motor tankers for ocean transportation of oil. But, as far as the other large independent domestic oil companies are concerned, not a single oil-engined vessel has been laid down. The president of one large oil company within the last month stated that "he has no use for motorships at the present time,

as he does not believe they are reliable." Nevertheless, his company has done nothing towards developing or perfecting the marine heavy oil-engine. If the Diesel engine is unreliable surely it would be to the advantage of his company to assist in its perfection?

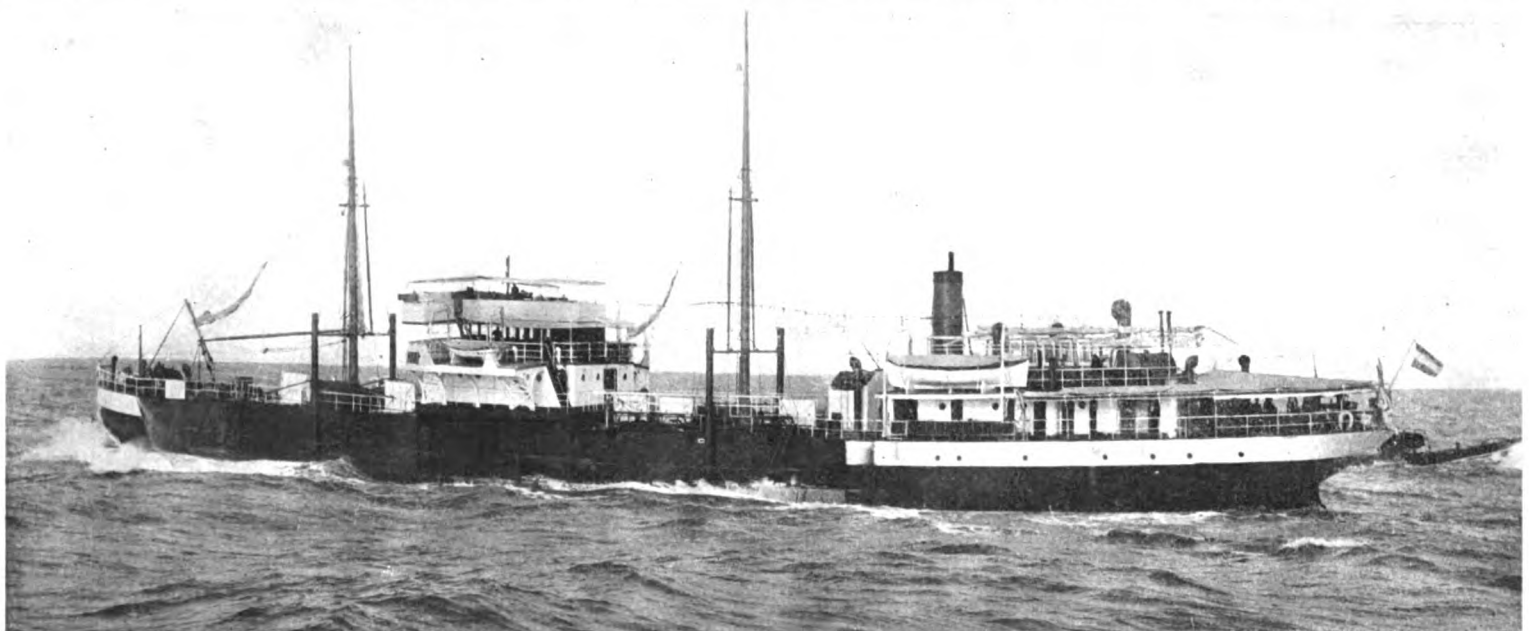
During recent weeks much has been published in the daily papers concerning the current activities of that great oil combine, the Royal Dutch-Shell, and its numerous associated companies, in which the British Government now has so strong a financial interest, and how their combined enterprises are extending right across the United States and Mexico, as well as all over other parts of the world, also how they are to spend one hundred million dollars in oil-development in Mexico.

From time to time these developments have been outlined in the columns of "Motorship," and on page 11 of our issue of February, 1918, a clear conception of the future was given in an article entitled "Competitive Motorship Transportation and Its Effect

Upon America's Vast Oil Trade Abroad." In the same we indicated the tremendous competition in the oil markets that would exist after the war, and the importance of building economical motor tankships in America to avoid possibilities of almost complete loss of foreign markets when peace arrived. Nevertheless, our suggestions were not adopted. Those connected with the oil industry may find it interesting to re-read this article and "check-up" the accuracy of "Motorship's" forecast. Part of this article we reprint as follows:

"Of one thing there can be no doubt, and that is—that large ocean-going Diesel motorships will play a far greater and more active part in the after-war competitive general commerce of the world than many of us probably care to confess or even let ourselves think at this time.

"Particularly is this the case with America's foreign oil-trade, and oil-transportation, where, unless some unforeseen situation arises, indications tend to show that competition a few years after the war will be more strenuous and much harder fought than during any pre-war oil rivalry, so it behooves the principal oil-companies of this



The single-screw Diesel-driven tanker "Juno," built 1912, and operated by the Anglo-Saxon Petroleum Company of London. Underwent her second Lloyd's survey January, 1917, at Newport News, Va., with little in the way of repairs necessary to her motor, which is 1,100 B.H.P. (1,460 I.H.P. at 115 R.P.M., equivalent to 1,300 steam I.H.P.). Vessel is 258 feet B.P., 45 feet beam, 18.6 draught, 4,300 tons displacement, carries 2,500 tons cargo on a D. W. C. of 2,675 tons at an average loaded speed of 9 3/4 knots

great mineral-oil producing country to take similar preparatory steps to those being made by the greatest of foreign oil-companies.

"Our great oil-companies are controlled by energetic, wide-awake men of keen perception; but, present circumstances might not offer them such free movements in this direction as they may desire. These, of course, are abnormal times.

"America must endeavor to continue with carefully planning and arranging her after-war world-wide commerce, because her war-debt to her own people probably will run into hundreds of thousands of millions of dollars, entailing expenditures that a few years ago would have been considered beyond wildest dreams, and which monies will produce comparatively minute trade, its productual results being scattered in the form of smoke and devastation on the battlefields of Europe. World-wide commerce after the war will enable the people of the United States to bear this heavy burden with complacency and financial strength. This is one reason why the Federal 'Powers-that-be' should give shipowners back their ships as soon as the immediate exigencies of war are adequately met.

"During the last decade one of the principal lines of America's overseas business has been the supply and transportation of oil; thanks to splendid work accomplished by several of our leading oil-companies. But, other countries also have realized what that magic word 'oil' means, and that it is the future power of the world. Consequently, unless steps are taken to economically transport oil from our shores, America's great overseas oil trade—particularly the British market—is threatened with a very severe loss if not total extinction.

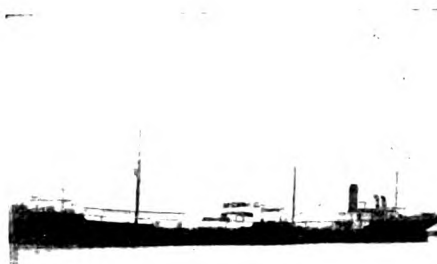
"Unless foreign countries can import oil into England cheaper than British and Dutch interests can produce and transport the Persian supply, it stands to reason that the authorities will favor oil from which they themselves derive substantial benefit. The situation will be aggravated if large quantities of oil are discovered in Great Britain, which is now being drilled, also when the Rumanian fields once more are opened.

"The logical solution of the pending blow to America's foreign oil-trade would be for the United States to build a fleet of Diesel-driven tankers as quickly as possible, in order to considerably reduce the overseas transportation costs of oil. This may not entirely overcome the difficulty; but, at least it should place this country in a position to send oil into Great Britain at a cost lower than British interests can produce it after the war.

"If the domestic built crude-oil engine is not as perfect as claimed by manufacturers, financial assistance must be made available by shipowners, by oil-companies, and, by the Government, to make it perfect. Even if this costs several million dollars it would be a profitable business investment, America must not heed any expense until the Diesel engine far exceeds marine steam power in reliability under the most strenuous conditions of maritime service. America has the money and should possess the finest and most economical type of ocean cargo-carrier it is possible to build."

At the back of the Royal Dutch-Shell combine there is a great master-mind who realized many years ago the enormous advantages that would accrue if the economical Diesel engine could be developed for ship propulsion and used for the transportation of oil. It was this farseeing man who was responsible for the first full-powered ocean-going motorship, namely, the "Vulcanus."

Only the dearth of materials in their associated ships and engine building yards, and the necessity of all British Diesel engine



The motorship "Emanuel Nobel." During the war the crankshafts of her engine broke, due to weak engine foundations, and because of the difficulty in securing new crankshafts, steam-engines were substituted; but the latter now are to be removed and replaced with Diesel engines of the same make, which illustrates the owner's confidence in motorships

facilities being devoted to naval purposes during the war, have prevented the adding of many additional motorships to their great oil-carrying fleet. As it is they have placed quite a respectable number of motorships in service, two of which have been sunk by mines or submarines. These vessels are as follows:

Ship	Displacement Tonnage	Type of Engine	Indicated Horse-power	Date Ordered
"Vulcanus".....	2050	Werkspoor-Diesel	650	Feb. 1910
"Juno".....	4370	Werkspoor-Diesel	1600	Apr. 1911
"Emanuel Nobel".....	9560	Werkspoor-Diesel	2900	Apr. 1911
"Ares".....	7725	Werkspoor-Diesel	2300	Feb. 1912
"Artemis".....	7725	Werkspoor-Diesel	2300	Feb. 1912
"Elbruz".....	9560	Werkspoor-Diesel	2900	Apr. 1912
"Selene".....	7725	Werkspoor-Diesel	2300	Apr. 1912
"Hermes".....	7725	Werkspoor-Diesel	2300	Apr. 1912
"Poseidon".....	1340	Werkspoor-Diesel	450	May 1913
"Utrecht".....	2360	Werkspoor-Diesel	800	July 1913
"Lara".....	1575	Werkspoor-Diesel	650	Aug. 1913
"Hestia".....	1575	Werkspoor-Diesel	650	Feb. 1915
"Hebe".....	1575	Kromhout Hot-bulb	700 1915

In addition, several steel sailing-ships have been purchased during the war, and Bolinder oil-engines installed as auxiliary power. But it will be noticed that the construction of motorships for Royal Dutch-Shell interests only stopped with the war and the consequent great difficulty of obtaining new ships and Diesel engines. At one period the Anglo-Saxon Petroleum, who operate all these tankships, were interested in securing Diesel engines from America—for converting sailing-ships. Now that the war is over we can expect that they will order many more

full-powered motorships for oil-carrying purposes, and thus continue their good work.

The marketing company for the Royal Dutch Petroleum Company is the Asiatic Petroleum Company, Ltd., who have oil-fuel stations in the principal ports of the world. They have kindly furnished "Motorship" with some illustrations of several of their oil-carrying motorships, together with abstracts from the logs of these vessels. These abstracts will indicate the importance of the wonderful economy of the Diesel engine in so far as oil transportation is concerned. These reports, it will be noted, are of recent date, and were made to the Asiatic Petroleum Company by the Marine Department of the Anglo-Saxon Petroleum Company, who manages all their shipping. We append these reports as follows, namely:

REPORT OF MARINE DEPARTMENT JANUARY 7TH, 1919 M. V. "Selene"

This ship which is owned by the Petroleum Maatschappij "La Corona" of the Hague, one of the companies associated with the Anglo-Saxon Petroleum Co. is the first motorship which has made a round-the-world trip successfully.

The following are particulars of the vessel:

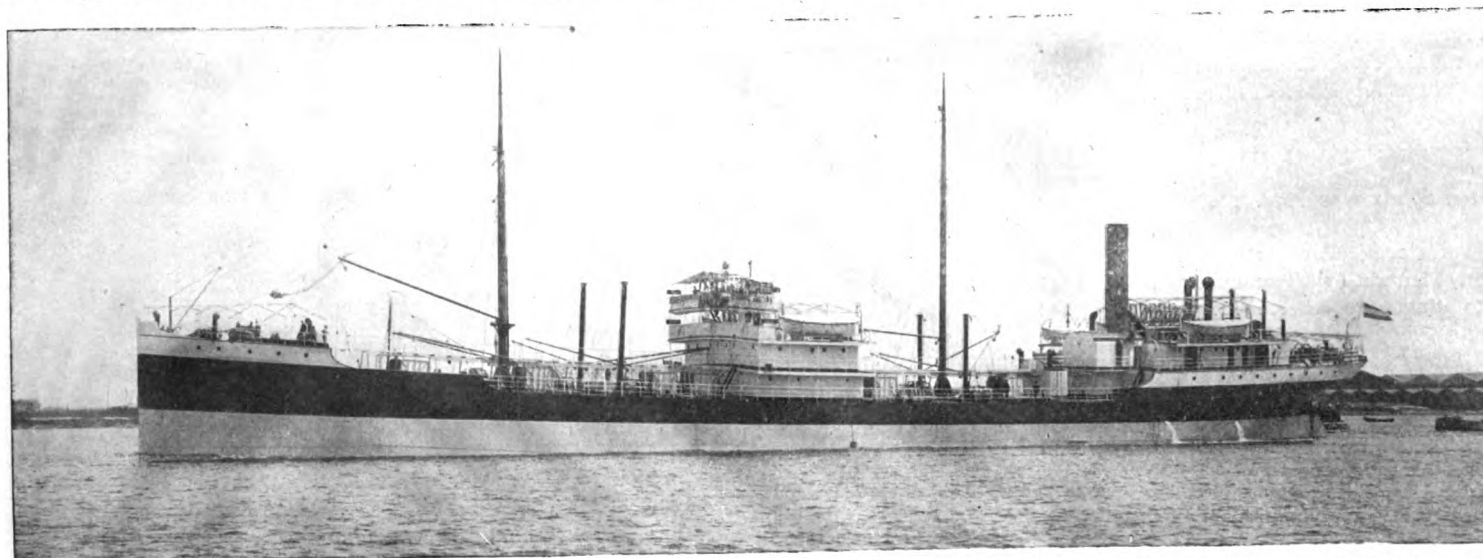
Built in 1914 by the Caledon Shipbuilding and Iron Co. of Dundee, Scotland, and fitted at Amsterdam with two 4-cycle, 6-cylinder, 20½ in. diam. by 35½ stroke direct reversible Werkspoor-Diesel engines of 900 b.h.p. each. The ship is designed for the carriage of petroleum in bulk and case-oil. She is illustrated below.

Length	357 ft. 6 in.
Breadth	46 ft. 3 in.
Depth	27 ft. 7 in.
Gross tonnage.....	3738 tons
Net tonnage.....	2273 tons
Deadweight	5170 tons
Displacement	7840 tons
Draught	22 ft. 4 in.
7 pairs main tanks	
4 pairs summer tanks	
Capacity.....	244,000 cu. ft.
Can load full cargo of case-oil..about 118,750 cases	

Particulars of Machinery

The motors are started by compressed-air, which is received from in-blast air vessels where the air is worked up to a pressure of 65 atm. Further, there are 4 manoeuvring air-vessels to supply air to the main and auxiliary motors, ballast-pump, anchor-windlass and winches; they have a pressure of 300 lbs. The auxiliary motor which is of the 4-cycle, 6-cylinder Werkspoor-Diesel type, of 150 b.h.p. serves to drive 2 centrifugal pumps with suitable gear and is also connected to the air-compressors which are to supply air to the manoeuvring air-vessels. The motive power of the motors is solar-oil or heavy-oil.

Air Compressors. These are driven by the auxiliary motor and fitted for manoeuvring the main motor-engines, and for working the winches, anchor windlass, pumps, whistle, reversing-engine, and steering gear. The air-compressor is also suitable for supplying compressed air of 950 lbs. for one main motor at full speed.



The Asiatic Petroleum Company's Diesel engine tanker "Selene." This great oil-company has given splendid assistance to the development of the marine heavy-oil engine

The Donkey Boiler of horizontal multi-tubular marine type works with a pressure of 120 lbs. and is fitted for burning coal or liquid fuel. It is heated at sea by the exhaust-gases of the main motors, which have a temperature of 400 degs. The revolutions of the main motors per minute vary between 114/120 per minute.

The daily consumption for main motors only is about 5½ tons; with auxiliaries, about 7½ tons.

Below is an extract from the log of the "round the world" voyage:

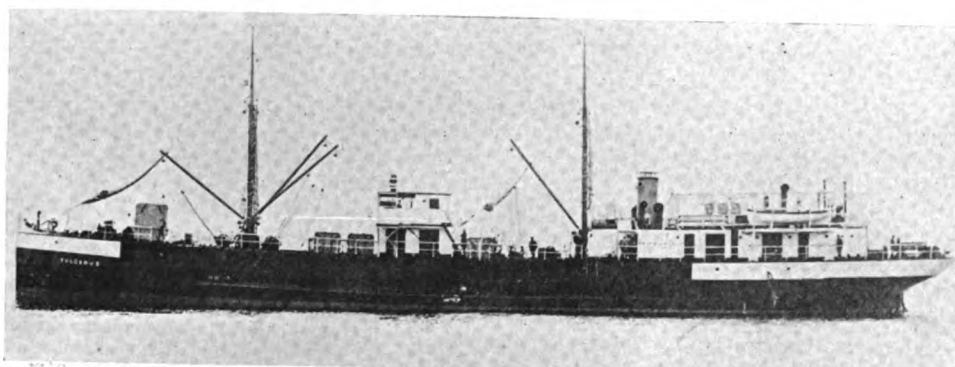
Sailed Cardiff,

19.12.14 at 8.15 A. M., with 248.5 tons oil fuel
 Arrived Port Arthur.....13.1.15 at 1.45 P. M.
 Sailed Port Arthur.....21.1.15 at 7.00 P. M.
 Arrived Tientsin.....16.3.15 at 2.40 P. M.
 Sailed Tientsin.....20.3.15 at 0.15 P. M.
 Arrived Singapore.....1.4.15 at 10.30 A. M.
 Sailed Singapore.....6.4.15 at noon
 Arrived Pladjoe.....8.4.15 at 7.30 A. M.
 Sailed Pladjoe.....11.4.15 at 6.40 A. M.
 Arrived Singapore.....13.4.15 at 0.10 A. M.
 Sailed Singapore.....15.4.15 at 2.15 P. M.
 Arrived Suez.....8.5.15 at 8.20 A. M.
 Sailed Port Said.....12.5.15 at 9.20 A. M.
 Arrived Rotterdam.....3.5.15 at 4.15 A. M.

Oil fuel, 240.6 tons.

Consumption During Voyage.

	Tons
Loading Cardiff.....	248.5
Loading Port Arthur.....	509.4
Loading Singapore.....	172.6
Loading Singapore.....	92



The first ocean-going full-powered motorship—the "Vulcanus." To date she has covered 252,000 nautical miles at 7 knots average speed. Her engine is of 400 b.h.p. and was the first crosshead-Diesel engine ever constructed.

Loading Suez.....	136.1
Total	1,158.6
Remainder on arrival at Rotterdam.....	240.6
Total consumption.....	918

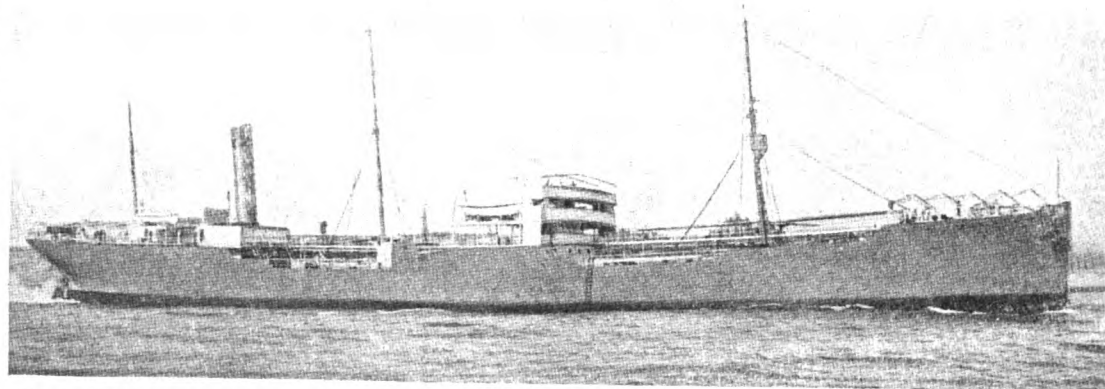
Port Consumption.

	Tons.
Port Arthur.....	6.4
Tientsin	4.4
Singapore	6.8
Pladjoe	1.5
Singapore	1.8
Suez/Port Said.....	4.5
Total	25.4

Consumption at sea was.....	892.6
	Miles
Distances run Cardiff/Port Arthur.....	5,140
Port Arthur/Tientsin (via Panama Canal) ..	10,942
Tientsin to Singapore.....	2,846
Singapore to Pladjoe.....	253
Pladjoe to Singapore.....	253
Singapore to Port Said.....	4,961
Port Said to Rotterdam.....	3,340

Total distance..... 27,735

The "Selene" has been continuously running long voyages since the "round the world" voyage, very satisfactorily, and is at present trading in the Eastern Hemisphere.



The motor tanker "Elbruz," propelled by Werkspoor-Diesel oil-engines of 3,000 i.h.p. at 115 r.p.m. Speed 12 knots. Fuel-consumption 60-65 barrels per 24 hour day. She has a loaded displacement of 9,000 tons, and can carry over two-million gallons of oil-cargo. Total engine-room crew of 12 men. She was built in England by the Tyne Iron & Shipbuilding Co. for Royal Dutch-Shell interests.

REPORT OF MARINE DEPARTMENT, JANUARY 10TH, 1919 M. V. "Vulcanus"

This ship is the pioneer of sea-going motor vessels. She was built in 1910 by the Nederlandsche Scheepsbouw Maatschappij, Amsterdam, and up to the present has run satisfactorily. She has covered a total amount of 252,000 nautical miles and during the last 5 to 6 years has been employed in the East Indian trade.

The ship was built for the carriage of oil in bulk or in cases and general cargo, and is a steel single-screw 2-masted motor-vessel with one steel deck and upper deck, web frames with engine aft. There are 6 pairs of tanks separated from the motor room by a cofferdam aft; there is also a cofferdam forward.

of tanks of a total capacity 1,100, 52,030 cubic ft; 1,144 tons kerosene (30,000 cases).

The total bunker capacity is 229 tons.

The ship is driven by one 6-cylinder 4-cycle direct-reversible Werkspoor Diesel engine with cylinder diameters of 15¾ in. and a stroke of 23½ in. developing 490 i.h.p. = 390 b.h.p. She has also a small vertical boiler for central heating and an auxiliary motor developing 50 i.h.p. for driving a centrifugal pump, by means of a clutch, and also to supply air on deck to the windlass and winches, which are driven by compressed-air instead of steam.

The ship has a 4-blade propeller averaging 140 revolutions per minute; average speed is 7 knots.

There are 4 manoeuvring air-vessels supplying air for main and auxiliary motors. Electric-light is supplied by a separate 5 h.p. Deutz (Bronx type) motor, which is driven by kerosene.

REPORT OF MARINE DEPARTMENT JANUARY 11TH, 1919 M. V. "Juno"

This ship was built in 1912, and has up to the present run very satisfactorily. She was one of the first motor-vessels to be fitted with Diesel engines of that size. The ship was built at Nederlandsche Scheepsbouw Maatschappij, Amsterdam, and fitted with motors by Werkspoor of Amsterdam, for account of the Nederlandsch Indische Tank Stoomboot Mij., and fitted to carry oil in bulk, also case oil and general cargo. Hereunder follow some particulars:

Dimensions.. 271 ft. 4 in. x 43 ft. 1 in. x 19 ft. 10 in.
 Height of trunk..... 8 ft.

Description.

Steel single-screw
 2-masted motor-vessel
 One steel deck and harbor deck, with machinery aft
 Gross tonnage..... 2,345 tons
 Net tonnage..... 1,387 tons
 Deadweight

Displacement.

4,290 tons.
 Draft 18 ft. 1 in.
 Number of main tanks, 6 pairs.



The motorship "Hebe," owned by Royal Dutch-Shell interests. She was built by the Dordrecht Shipbuilding Co. of Dordrecht, Holland.

Total cargo capacity, 126,135 cu. ft. = 2,275 tons kerosene.

Number of cases to be loaded, 66,600.

Bunker capacity, 353 tons.

Fitted with donkey boiler. One steel single-handed boiler, working pressure of 80 lbs. Heated at sea by the exhaust-gases from the main motor; in port heated by liquid fuel.

Main Engines.

One 6-cylinder 4-cycle direct-reversible Werks-poor Diesel engine.

Cylinder diameter, 22 in. by 39% in. stroke, developing 1,100 b.h.p. = 1,400 i.h.p.

The motive power of the main motor is solar or heavy-oil.

Daily consumption of the main motors is 4.4 tons, excluding the auxiliaries.

The ship has further 3 manoeuvring air-vessels with a pressure of 225 lbs. to supply air to the main motor, and auxiliaries also air supply to windlass and winches.

The auxiliary-motor has a capacity of 100 b.h.p. and is used for driving the pumps filling the manoeuvring air-vessels and the auxiliaries. The ship is further supplied with a Deutz (Brons-type) motor for lighting purposes, driven by kerosene, and started with benzine.

The advantage of the auxiliary motor also being fitted to drive the cargo pumps is that no fires have to be lit, thus preventing danger whilst handling highly inflammable oil.

Log Abstract.

From the voyage New Orleans to Sydney. Left New Orleans 12th October 7.10 A.M.; arrived Sydney 1st December, 9.25 A.M.; distance run, 9,100 miles.

Consumption.

	Tons
Bunkers leaving New Orleans.....	359
Arrival Sydney.....	117
	242

Daily consumption, 4.83 tons.

Consumed, per mile, 57.8 lbs.

The ship is at present trading in the East Indies, and is doing very satisfactorily.

Our Readers' Opinions

(The publication of letters does not necessarily imply Editorial endorsement of opinions expressed.)

A COMPLIMENT FROM ITALY

To the Editor of "Motorship,"

Sir:—

I have received the February issue of "Motorship" and have found it more interesting and more important than that of December, and I can state that you have actually fully succeeded in your endeavors to increase from number to number the merits of your esteemed periodical.

Yours very truly,

PIO PERRONE,

President.

Societa Anonima Italiana,
Gio Ansaldo & Co.,

Rome, Italy.

[The above shipbuilding and engineering company is the largest in Italy and is one of the greatest in the world. Its fully-paid capital exceeds one hundred million dollars.—Editor.]

YET ANOTHER COMPLIMENT

To the Editor of "Motorship."

Sir:

We find we are getting very valuable information from your current issue, and would like to have copies of your past year for our files.

Yours very truly,

RUSSELL SHIPBUILDING CO.,

By F. H. Evans.

Shipbuilding Contractor for the
U. S. Shipping Board,
Emergency Fleet Corporation,
Portland, Maine.

WHERE FUEL-OIL CAN BE OBTAINED

To the Editor of "Motorship,"

Sir:—

I have read with great interest the article in your March number concerning ports at which fuel-oil can be obtained and you will be interested, I am sure, to know that Rio de Janeiro, Brazil, has two large and very well equipped fuel-oil stations where ships can come right alongside and take on supplies.

One plant, that of the Caloric Co. is right in the City while the Agulla Co. has established its station a short way up the harbor.

Yours very truly,

F. E. PRATT,

c/o Bolinders Company,
30 Church Street, New York.

THE NEW NORWEGIAN MOTORSHIPS

To the Editor of "Motorship,"

Sir:

Referring to your article in the "Motorship" for December, 1918, we want to call your attention to a mistake. The 2,000 h.p. Werks-poor Diesel engine is for the "Sardinia," a single-screw vessel of about 3,000 tons d.w., and not for the larger 6,500-ton vessel for Messrs. Winge & Co. If you look over the list we sent you with our letter of August 31, 1918, you will see that we have stated this correctly, and that the mistake may have been made by your printers.

We may add that we have placed a contract for a duplicate of the "Sardinia," the "San Andres."

Very truly yours,

OTTO KAHRS.

Kommanditaktieselskab,
Raadhugaten 1 & 3,
Kristiania, Norway.

THE "BULLAREN" AND OTHER NEW SWEDISH MOTORSHIPS

To the Editor of "Motorship,"

Sir:—

The article on the motorship "Bullaren" in your January issue is very interesting and if we should venture to make any remarks it should be, that contrary to what is said on page 15, all the electric motors are made in this country by the big Swedish Electric Company "Asea," who has an agency in Copenhagen.

Our second motorship "Tisnarnen" is now on her way to Batavia from Durban, South Africa, having made her first trip from here (Göteborg) to Cape Town without stop at an average speed of 12½ knots fully loaded.

In the first part of April we expect to launch an 8,000 tons motorship for the Swedish-Mexico Line, and at the end of the same month we expect to deliver the 9,500 tons ship "Balboa" to the North Star Line of Stockholm.

Yours very truly,

AKTIEBOLAGET GOTAVERKEN.

Per Ernest H. Reder.

Göteborg, Sweden.

[The error regarding the engine of the electric motors was due to the Danish agency's name plate being on the motors.—Editor.]

ENGINE ROOM CONTROL AND PUBLICITY

To the Editor of "Motorship,"

Sir:—

With reference to the notation of the Editor's, following the letter by Mr. Mulligan in the April issue of "Motorship," you are informed that this firm advertises in a great many magazines. To one familiar with the Cory products, it is well known that the quality of the material and the service rendered is really in itself sufficient advertisement for our appliances. We have many competitors but recognize no superiors in building marine electrical equipments and mechanical communication systems.

Referring to the comparison in Mr. Mulligan's letter, we wish Mr. Mulligan every success in his new undertaking, as our motto has always been to "Live and Let Live," and we believe that Mr. Mulligan is rendering us a service in making the comparison of instruments of his manufacture and of our manufacture, which you have published in the April issue of the "Motorship." We may state, however, that all our advertising is along conservative lines, and advertising such as is being done by Mr. Mulligan in his above referred to letter, is not the standard of advertising which meets with our approval.

We trust you will give this letter the same publicity as that given Mr. Mulligan's letter.

Yours very truly,

CHAS. CORY & SON, Inc.

Per J. S. Jones, Engineer.

New York, N. Y.

GEARED TURBINE SHIPS

To the Editor of "Motorship,"

Sir:

To the interested onlooker—with a penchant for oil-engines—the extremely conservative attitude of shipping-men in general toward the heavy-oil engined ship during the past few years has only been surpassed in understanding by the manner in which they almost "fell over themselves" in their rush to adopt the steam geared-turbine for these ships. This type of machinery really was more of an experiment than the Diesel engine, but freighters with geared-turbine engines have been ordered in numbers running into the hundreds as an emergency war measure, while the Diesel type engine was considered as being too much of an experiment at a time when the nation was calling for ships—ships—and more ships. Yet every ten motorships completed meant an equivalent cargo-carrying capacity of eleven steamships.

The inconsistency of this policy has resulted in America being years behind Europe in the marine Diesel engine construction, and the geared-turbine ship is a dead issue as far as the future freighter of the American merchant marine is concerned, for there can be no doubt but that many geared-turbine ships have been more or less of a failure. It is generally known that dozens of vessels already launched are still waiting at the fitting-out docks for satisfactory gears.

I have been told by ship-owners who operate

some of these new geared-turbine vessels that their running has been most unsatisfactory, and that after a single transatlantic voyage from \$15,000.00 to \$20,000.00 has often been spent for repairs and alterations.

I have also heard of vessels which had to be laid-up in foreign ports for more than a month waiting for spare parts to be sent from this country, also these vessels, instead of averaging their designed 11-knots speed, have usually done 6 and 7 knots. Not only that, but the least thing, such as faulty priming of the boilers have seriously damaged the turbines and the slightest grit in the lubricating-oil has badly damaged the gears. The result of the foregoing is that large quantities of lubricating-oil has had to be thrown overboard after being used only once.

I refer to these in a comparative way only and am quoting them just as they have been told me. Perhaps you can find space in your columns in order to show that the so-called conservatism of the past was nothing more or less than prejudice against something radically more efficient. If there should be any trace of prejudice left, it is to the interest of America's future merchant marine to have it quickly swept away.

Anyone sufficiently interested can refer to the four classes of cargo ships to be built under the new construction programme announced by Mr. Rosseter of the Shipping Board and will find that the geared-turbine has been entirely eliminated as a prime mover. However, it may pay manufacturers of reduction-gears to concentrate their energies on reduction-gears for use with high-speed Diesel engines. The medium-weight submarine type engine runs at much lower speed than the turbine, so the gear-reduction job stands a much better chance of being a success, and as proof of the above I want to refer to the numerous reduction-gear motorships already placed in service by some of our ship-owners.

Turbine ships driven by steam do not always mean reliability any more than that every object which sparkles is a genuine diamond.

Yours very truly,

GEO. P. HOLM.

Chicago, Ill.

[Your letter is more suited for the columns of a steamship publication than those of our own. Nevertheless, we will give it publicity in order that shipowners may reply.—Editor.]

GEAR REDUCTION DRIVE FOR MOTORSHIPS

Writing in our British contemporary the "Motorship & Motorboat," Mr. A. P. Chalkley, the Diesel-engine expert (now Assistant-Controller, Indian Munitions Board), refers to the use of reduction-gears in conjunction with high-speed Diesel engines as adopted in several full-powered American motorships. He says: "Most Diesel engines built in the United States (up to 1000 H.P.) run at from 240 to 300 r.p.m., according to the power, which is certainly higher than the majority of corresponding European motors, and so shows a better case for the employment of gearing. But, if a 3 to 1 ratio be used, giving a propeller speed of 80 to 100 r.p.m., it is doubtful if the propeller efficiency would be increased more than 10 per cent at the very maximum, whilst there would probably be a loss of 4 per cent in the gearing, leaving a net gain of only 6 per cent at the most. It is extremely doubtful if this is worth while, allowing for the extra capital cost of the gearing and the possibilities of troubles which it introduces. On the whole I see little hope for the future of geared motorships. Frankly, the innovation does not seem to be needed!"

We suggest that American engine builders and designers responsible for the installations referred to reply to Mr. Chalkley's views through the medium of our columns. Probably there are two sides to the question.

Interesting News and Notes from Everywhere

THE "MOUNT HOOD"

The Winton Diesel-engined wooden motorship "Mount Hood," sister vessel to the "James Timpson" recently described in "Motorship," is owned by Mr. M. Issaken, of Christiania, Norway.

NORWEGIAN DIESEL-DRIVEN AUXILIARY

The wooden schooner "Fagerli," 315 tons gross, owned by Mr. J. Austad, Shipowner, Tromsø, Norway, has been fitted with a two-cycle type Polar Diesel oil-engine.

SWEDISH MANUFACTURERS INTERESTED IN AMERICAN MARKET

The Aktiebolaget Ingeniorsfirma Fritz Egnell of Stockholm, Sweden are interested in entering negotiations with some responsible American firm for the construction of their surface-ignition type marine and stationary engines in the United States. The trade name of their engine is the "HEXA."

MOTORSHIP "HJELTENAS" SOLD TO FRANCE FOR \$670,000.00

It is reported that the motor-auxiliary wooden ship "Hjeltenas," built on the Pacific coast, has been sold to French owners for \$670,000.00. Her owners were Ericksen & Andersen, Bergen, Norway.

FRANCE AND MOTORSHIPS

In a letter to "La Ligue Maritime Française," Mons. Henry Laurier, Head Commissioner of Marine, and member of the Higher Council, strongly advocates the construction of oil-engined merchant motorships by the French Government, or encouragement to the industry by means of subsidies or premiums to builders.

MORE AMERICAN MOTORSHIPS FOR FRANCE

The wooden motor-auxiliary schooner "Adrien Badin," 1,622 gross tons, built in 1917 by the Peninsular Shipbuilding Co. Portland, Ore., is owned by the Societe de Treilleries et Laminiers du Havre, of Marseilles. This vessel is propelled by two 6-cylinder four-cycle type 350 b.h.p. Winton Diesel oil-engines. The company also own the sister motor vessel "Pechivry," also Winton Diesel engined.

U. S. SHIPPING BOARD PURCHASES DIESEL ENGINES ABROAD

We have been officially advised that Mr. Edw. N. Hurley has purchased for the U. S. Shipping Board two twin-screw Diesel engine installations for motorships of 9,800 tons d.w.c. from Burmeister and Wain of Copenhagen, Denmark. Each of these installations will be of 4,300 I. H. P. and will give these vessels a loaded-speed of 13-knots. Drawings of these ships were published in the April issue of "Motorship" on page 20.

THE NEW MOTORSHIP "ASIA"

The new Danish twin-screw steel motorship "Asia," recently launched at Copenhagen for the East Asiatic Company, has the following dimensions:

Length.....	425.3 ft.
Breadth.....	55.2 ft.
Depth.....	38.6 ft.
Gross Tonnage.....	6,950 tons
Net Tonnage.....	4,550 tons
Classification.....	Lloyds 100 A1
Engines.....	Two 6-cylinder 24 13/16" bore by 37 13/16" stroke, four-cycle Diesels

As mentioned in a recent issue, her building-way is now occupied by a 12,000 tons d.w.c. motorship.

PROPELLERS FOR MOTORSHIPS AND MOTORBOATS

The new catalog of the Columbian Bronze Corporation has just been issued, and is entitled "Propellers in a Nutshell." It is a 48-page, 6 in. x 9 in. book, which contains a mass of information of real interest to all owners and prospective owners of motorships and motorboats. In addition to illustrating, listing, and describing motor-boat propellers, this book gives, for the first time, full details concerning the Columbian Motorship and Heavy Work-Boat wheels.

At the back of the book are valuable tables covering speed of boats in miles-per-hour in relation to the diameter and pitch of the propeller used, also a time and speed table whereby it is easy to figure the speed of your boat after either the statute or nautical mile. A limited edition of this book has been published, but we have arranged for a copy to be sent to all of our readers who will write to the Columbian Bronze Corporation, 50 Church Street, City of New York, and mention "Motorship."

THE "CITY OF GALVESTON"

The motor auxiliary wooden schooner "City of Galveston," 1,975 tons gross is fitted with two Fairbanks-Morse oil-engines. She was built by the International Shipbuilding Co. of Orange, Texas for the Italo-Navigation Co.

THE STILL-ACKLAND ENGINE

We shall be glad if the makers of the Still-Ackland combination Diesel and Steam marine engine will forward their address. This is one of the oil-engines developed in Great Britain during the war.

NEW ITALIAN MOTORSHIP

There has been built at Cornigliano Lugure, Italy, the steel twin-screw motor vessel "Ironzo" for the Societe Nazionale di Navigazione of Genoa. This vessel was constructed by the Cantieri Officine Savola, a subsidiary of Gio Ansaldo & Co., and is propelled by two 4-cylinder two-cycle Sulzer type 13% in. bore by 21 1/4 in. stroke Diesel oil-engines, built under license by the Savola Company. She is of 1,105 gross tons, 214 ft. length, 31.4 ft. breadth, and 17.5 ft. depth.

MORE ROYAL DUTCH PETROLEUM ACTIVITIES

With reference to remarks made in our last issue regarding recent developments of the Royal Dutch Petroleum Company, it is rumored that in addition to having purchased the Anglo-Mexican Petroleum Company, they have acquired a substantial interest in the Mexican Petroleum Company, which after the Standard Oil Co. is one of the most important of American Oil concerns. We also learn that the Anglo-Persian Oil Co.,—a Royal Dutch Subsidiary,—has entered into working arrangement with the Cypress Oil Co. for the development of its properties, including new fields just acquired in Bulgaria.

PRICES OF MARINE ENGINES IN GREAT BRITAIN

According to "Nauticus," the following prices are now ruling in the British engineering trades:

(1000 to 2000 I.H.P.)			
Reciprocating engines.....	L16/0/0	(\$77.92)	per I.H.P.
Geared turbines.....	L18/0/0	(\$87.66)	per I.H.P.
Diesel engines.....	L32/0/0	(\$155.84)	per I.H.P.
(3000 to 5000 I.H.P.)			
Reciprocating engines.....	L15/0/0	(\$73.05)	per I.H.P.
Geared turbines.....	L17/0/0	(\$82.79)	per I.H.P.
Diesel engines.....	L30/0/0	(\$146.10)	per I.H.P.

The above figures are based on complete engine installation, including boilers and auxiliary machinery. Machinery for passenger vessels is from 15 per cent to 20 per cent higher.

THE NEW AUSTRALIAN GOVERNMENT MOTORSHIPS

Regarding the new wooden motorships building for the Australian Government by the Patterson & MacDonald Shipbuilding Co. of Seattle, Wash., their dimensions are as follows:

Gross Tonnage.....	2,900 tons
Net Tonnage.....	1,800 tons
Length.....	267 ft.
Breadth.....	47.9 ft.
Depth.....	27.4 ft.
Power.....	1,000 b.h.p.
Classification Contemplated.....	Lloyd 12 A1

Each is being fitted with two six-cylinder 16-in. bore by 24 1/4 in. stroke McIntosh & Seymour four-cycle type Diesel-engines. The first two of these vessels have been named the "Benowa" and "Babinda."

DEATH OF NOTED MARINE DIESEL ENGINE DESIGNER

On Tuesday, February 18th, Max C. Wurl passed away at his residence in Newcastle-on-Tyne, a victim to the prevalent Influenza plague. He joined the firm of Wigham Richardson & Co., (now Swan, Hunter & Wigham Richardson, Ltd.), in 1900 as technical-assistant to the late John Tweedy, the Engineering partner. For fifteen years he was Chief-Designer at the Neptune Engine Works of the firm and was in charge of all scientific and experimental work carried on there. Much work was done at Neptune Works in developing the application of the internal-combustion oil engine to marine work, and Mr. Wurl evolved the Neptune Diesel engine, a slow running, two-cycle type marine engine, which proved most successful in the vessels in which it has been installed. His loss is a serious one to the Marine Engineering profession as a whole, for his scientific knowledge was exceptional and his grasp of the problems of marine propulsion extraordinarily complete.

THE M. A. "RUBIS," EX RUBY

The little motor auxiliary "Rubis" built in 1916 by the St. Helens Shipbuilding Co. of St. Helens, Oregon, now is owned by the Societe des Transports Houilliers, of Le Havre, France. She is of 557 tons gross, and is fitted with two Fairbanks-Morse oil engines. Her original name was 'Ruby.'

ADDITIONAL NORWEGIAN MOTORSHIPS

"It is reported," says the Liverpool Journal of Commerce "that more contracts have been placed by Norwegian shipowners for full-powered standard motorships of about 7,200 tons d.w.c. and 12 knots loaded speed. The hulls are to be built in Norway and the Diesel engines in Holland. Each vessel will be given two six-cylinder four-cycle type Werkspoor Diesels of 1,500 I.H.P. each." These vessels must be in addition to the list of Werkspoor Diesel engined vessels for Norway recently given in "Motorship," because in the latter case both engines and hulls are being built in Holland, and there are eight of these.

SOLID-INJECTION "DIESEL" ENGINES AND SMOKE

According to a British submarine officer, solid-injection "Diesel" oil-engines are capable of continuous hard work and can stand the most vigorous conditions of service, but suffer from clouds of smoke. No matter how carefully they may be adjusted they smoke, and if the engine-room staff are not careful a smoke-screen effect can be only too easily produced. Particularly was this noticed with the E-Class of British submarines.

The same officer says that the majority of the German submarine officers say they prefer the four-stroke air-injection M. A. N. (Augsburg) reversible Diesel engine, and that two-stroke engines are losing favor with them. He also says that they are, without exception, the finest submarine engines produced by a very long way, and are far ahead of the British models.

SUBMARINE BOAT CORPORATION AND MERCHANTS MARINE DIESEL ENGINES

In the Submarine Boat Corporation's report for the year 1918 the following remarks appear:

"The technical forces of the Company have been studying with great care the development of a proper Diesel engine for cargo vessels, which is of a different type from that required for submarine torpedo boats, and it is expected that during the coming year Diesel engines of large power will be produced by us which will create a large business for the manufacturing facilities of the Company and may require additional plants for the manufacture of such Diesel engines in quantity.

"The commercial value of large Diesel engines for the operation of cargo vessels has been demonstrated by certain engines of European design and we believe that these results can and will be fully equalled if not excelled by the engines to be produced by this Company."

The Submarine Boat Corporation are, of course, associated with the New London Ship & Engine Co., whose Diesel-engine plant was fully described in the last issue of "Motorship."

WHAT MOTORSHIPS MEAN TO AMERICAN SHIPOWNERS

We have the facilities for building and can operate full Diesel motorships better than any foreign nation. Above all, no time should be lost, as instant action is necessary, and it is up to local exporters, importers, manufacturers, general shippers, merchants, bankers to get together in a co-operative organization to build, own and operate 10,000-ton cargo carrying capacity motorships to go anywhere and home again without bunkering.

This should be done as a matter of self-preservation and good business; an extremely favorable profit can be made on the investment aside from the big savings that will be made directly and indirectly from lower freight rates that can be had from any steamship line now or at any time in the future.

We have really nothing to fear as to results of operation, as we can operate motorships \$3 to \$5 per ton cheaper than any competitor can operate his steamer on exactly the same run. * * * You can get known rates both ways with a co-operative line of motorships and be the masters of your own business. You could even go into New York with a \$7 rate or under and make the railroads sit up and take notice.—B. R. Douglas, in the "San Francisco Bulletin."

INDIAN REPRESENTATIVES FOR SKANDIA COMPANY

Messrs. Howson Bros., the well-known engineers of Calcutta, India have been appointed representatives for the Skandia and Werkspoor Diesel engine, built by the Skandia Pacific Oil Company of San Francisco, Cal.

NORWEGIAN SHIPOWNERS AND WERKSPOOR ENGINES

Mr. Otto Kahrs of Christiania, announces that Norwegian shipowners have placed orders through him for 8 motorships aggregating 41,450 tons dead-weight, to be fitted with 14 Werkspoor Diesel engines totaling 21,650 indicated H.P.

LARGE MOTORSHIPS IN THE PACIFIC TRADE

Recently the Danish Motorships "Panama" and "Peru" have been operating in the Atlantic; but their owners, the East Arctic Company of Copenhagen, will return them to the trade route between Seattle, San Francisco, Japan, and China. As soon as their 12,000 tons d. w. c. motorships are ready they will be placed in this service.

NEW NORWEGIAN MOTORSHIP LINE

The Dampskibsselskabet A/S Thor Thoresens Linje has been formed in Christiania with a capital of 6,000,000 kr. This new company is an amalgamation of Mr. Thoresen's Manchester line and the Skandinaviske Ost Afrika Line. This company has ordered five 9,700 D.W.C. motorships from the Werkspoor Engineering Works of Amsterdam, Holland that will be fitted with Werkspoor Diesel engines of 3,000 H. P.

NORTH EAST COAST INSTITUTION GOLD MEDAL

The Engineering Gold Medal of the North East Coast Institution of Engineers and Shipbuilders of England has been awarded to Mr. Harry R. Ricardo, B. A., for his Paper entitled "High-Speed Internal-Combustion Engines" which was read before the Institution on the 30th of April 1918. An extract of this paper recently was published in "Motorship."

SWEDISH MOTORSHIP "TISNARNEN"

It was expected that the 13-knot Swedish motorship "Tisnarnen" would come to New York on her maiden trip as did her sister ship "Bullaren"; but, in the early part of February the "Tisnarnen" left Goteborg for South Africa. She averaged 12.5 knots to Cape Town, whence she left for Batavia, Java, via Durban. This vessel, as is also the "Bullaren," is fitted with the newest type of Cedervall and Soner's protective and lubricating-box for propeller-shafts. This patented device is also to be installed on 18 large ore-carriers now under construction for the Grangeberg Co., a large mining concern of Stockholm.

WHAT "MOTORSHIP" SAID IN NOVEMBER, 1917

In view of Chairman E. N. Hurley's recent announcement regarding the future operation of government built ships, the following "editorial-leader" from the November, 1917, (page 18) may be of interest, viz:—

"It is reasonably safe to assume that Federal operation of the country's fleet of new and commandeered ships will practically terminate soon after the war is over and that most of the new vessels will be chartered or sold to private domestic shipping companies; otherwise the many foreign trade enterprises indirectly related to private ship-owning business may gradually become defunct or pass into the control of foreigners. For, there are hundreds of business enterprises abroad that have been built up by trading companies associated with shipping lines, or in co-operation with shipowners. Without constant building-up of new trade ventures in South America and elsewhere, also the maintenance of existing overseas developments, it is reasonable to say that dozens of our fine ships would eventually spend more time in harbors awaiting cargoes than at sea, under which conditions America's maritime supremacy would be but a dream.

"Ships are of no use without cargoes and passengers, and, to provide these cargoes and traffic, American capital and American enterprise must build up vast businesses abroad and American business-men must operate the ships to carry the trade thus formed. We refer, of course, to the more normal conditions that will follow the present abnormal situation. The present Government intervention in shipping doubtless will ultimately prove the best thing for the country; but should only be regarded as a war measure and not a

permanent institution. Federal shipbuilding probably will continue much longer than Federal ship operations, which is logical."

LARGE SPANISH MOTORSHIPS

The Compania Maritima del Nervion of Bilbao, Spain, propose to have built six 7,000 tons d.w.c. Diesel-driven 12 knot motorships for their New York—Marseilles service.

THE M. A. "WILLIAM LYALL"

In the new wooden auxiliary "William Lyall" built at Vancouver, B. C. two Fairbanks-Morse oil-engines are installed. This vessel is of 1,480 tons gross.

THE AUXILIARY "CAP FINISTERRE"

The wooden motor-auxiliary schooner "Cap Finisterre," 1,480 tons gross, is fitted with two four-cylinder 14-in. bore by 18-in. stroke Fairbanks-Morse surface-ignition oil-engines. The hull was built in 1918 by the Wm. Lyall Shipbuilding Co., North Vancouver, B. C.

INDIAN 1,500 TONS MOTORSHIP

At the shipyard of Geo. Brunton & Sons, Cochin, India-China, a cargo and passenger motorship of teak construction and of 1,500 tons loaded displacement is under construction in which two 150 b.h.p. Beardmore surface-ignition oil-engines are being installed. The vessel will be used in the Indian trade. She is a full-powered vessel and will carry no sails. Two gasoline-kerosene engines will drive the generators for furnishing current for the electrical winches, windlass, lighting-plant, pumps, etc. The cargo capacity of the ship will be 800 tons.

MOTORS IN DANISH FISHING FLEET

At Esberg, Denmark, the center of the fishing industry of that country, there are over 600 motor-driven trawlers. While the majority of these vessels are fitted with surface-ignition heavy-oil engines, there are a number of the smaller craft powered with kerosene motors. Of the heavy-oil engines most popular among the Danish fishermen is the Tuxham, manufactured by the Tuxham Maskinfabrik of Copenhagen. This motor has many features of design to commend it, and it is used as an auxiliary engine-room power in some of the East Asiatic Company's big motorships. Before the war this engine was introduced on the Pacific Coast of the U. S. A., but the submarine campaign interfered with the supply and the attempt to place it on the American market was temporarily abandoned. Now that better transatlantic shipping conditions exist we should not be surprised to see this engine make an early re-entry into this country.

THE UNITED STATES NAVY'S GREAT GROWTH

It is well to place on record what the United States Navy did in the way of constructing new war-vessels during the period of America's participation in the great war. The following are official figures kindly furnished "Motorship" by Secretary-of-the-Navy, Josephus Daniels.

The number of vessels placed in commission from April 6, 1917 to January 1, 1919 include the following:—

- 2 Battleships
- 55 Destroyers
- 41 Submarines
- 20 Mine Sweepers
- 7 Eagle Patrol Vessels
- 326 Submarine Chasers

To cover the entire war period from August 1, 1914, the following named vessels were placed in

commission between August 1, 1913 and April 6, 1917.

- 4 Battleships
- 17 Destroyers
- 15 Submarines

SPANISH AUXILIARY "DAMIANA"

Two four-cylinder Hispano-Suiza motors, built in Barcelona, have been installed in the Spanish wooden schooner "Damiana," built by Solar Villa y Cia of Villajoyosa for the Hispania Maritima S. A. This vessel is of 233 tons gross. Length, 99.4 ft.; breadth, 20.7 ft.; depth, 12.1 ft.

LARGEST SIAMESE-BUILT MOTORSHIP

The wooden auxiliary motorship "Orient," recently built by Phra Nart Noraserth, river Menam, near Paklat, Siam, has been sold to the East Asiatic Co. This vessel is 152 ft. long on the waterline, by 30½ ft. breadth, and 15 ft. depth, and is fitted with two surface-ignition oil-engines. She is the largest ship ever built in Siam.

"THE STORY OF THE SHIP"

One of the best books on ships for boys ever produced has just been issued by Messrs. McLoughlin & Bros., Inc., of New York, under the auspices of Mr. Edward N. Hurley, Chairman of the United States Shipping Board, who has written an introduction to this work.

The book has been issued with a view to encouraging the interest and pride of boys of the nation in our mercantile marine. It is profusely illustrated and deals with ships from the time of five thousand years ago, to the modern ocean leviathan. There is a page devoted to the marine Diesel-type oil engine. Certainly every father should secure a copy for his boy, as it would make an ideal present.

BRITISH NAVAL-EMERGENCY MOTOR BARGES

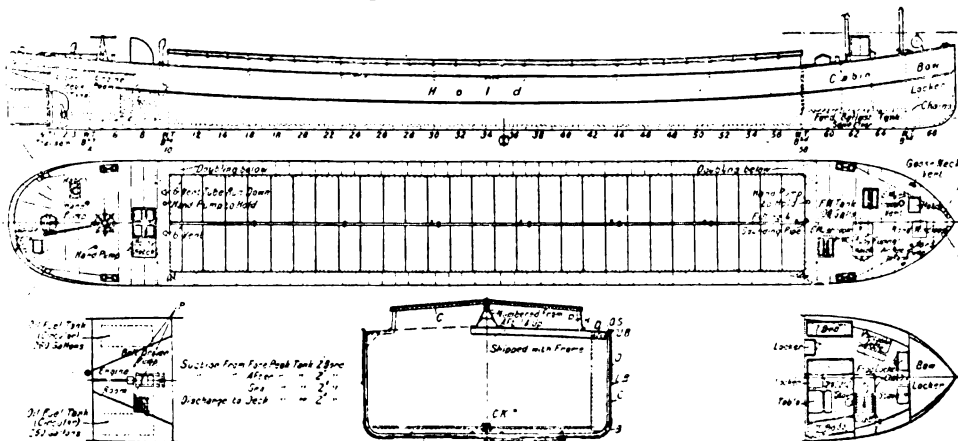
One of the most remarkable jobs undertaken in secret in Great Britain during the war was the building of the great barge construction yard at Richborough, England, near the new Channel train-ferry depot, of which recent revelations were made. The workshops and shipyards alone covered 47 acres, of which 4½ acres were covered-in. There are 25 building slips and two 880 ft. patent slipways for repair work, and at the height of production 8,404 men were employed. When work was commenced, like our famous Hog Island shipyard, the site was waste land.

Among the various craft (principally non-power barges) built at this yard were fourteen 200-ton d.w.c. steel motor barges. Also an oil-engined twin-screw motor hospital-vessel for the river Tigris and two other motor-barges were fitted out, and 113 motor-launches were repaired.

The fourteen motor-barges were laid-down in December 1917 and have the following dimensions:

Loaded Displacement.....	270 tons
Light Displacement.....	70 tons
Dead-weight Capacity.....	200 tons
Length O. A.....	126 ft. 6 in.
Length B. P.....	120 ft. 9 in.
Breadth.....	16 ft. 4 in.
Depth.....	7 ft. 9 in.

The vessels were used for canal work in France and Belgium and were found very satisfactory. They are each propelled by a 50 b.h.p. Kelvin gasoline-kerosene marine oil-engine of the four-cycle type, built by the Bergius Launch & Engine Co. of Dobbies Loan, Glasgow. Accommodation is provided for one non-commissioned officer and two men. A speed of 5 to 6 miles an hour was obtained. A belt connection from the main engine operated the bilge and ballast pumps. It was at this shipyard that the first British welded-steel barge was constructed.



One of the Kelvin engine motor-barges built at Richborough by the British Government for war service

Notes on Marine Oil-Engine Design

A New Reversing Valve-Gear—The Question of Solid-Injection

By R. D. KARR

THERE are as many designs of reversing-mechanisms and valve-gears for direct-connected Diesel engines for marine work as there are makes of engines. Such being the case it is with considerable timidity that the following suggestion is made regarding the manner and process by which reversing can be accomplished. The outstanding feature, however, is the fact that the mechanism would be inherently automatic; i.e.—the same mechanism and no more operates in astern motion as when going ahead, without temporary shiftings or adjustments of any kind. The gear may be applied to all the valves of both two-stroke and four-stroke cycle engines. It is at all times positively connected.

Inspection of the crank circle of the four-cycle Diesel engine will show the points of opening and closing of the valves to be about as follows:

Fuel-Injection—Opens, 4° before top-centre. Closes, 40° after top-centre.
Exhaust—Opens, 35° before bottom-centre. Closes, 6° after top-centre.
Inlet—Opens, 10° after top-centre. Closes, 20° after bottom-centre.
Air-Starting—Opens, 6° after top-centre. Closes, 80° after top-centre.

These crank angles are not actually taken from any design but they will serve to illustrate the action of the valve gear. Now taking the exhaust-valve for example and reckoning from the first top-centre of any cycle (or the beginning of the power stroke), it may be stated that the valve opens 145° after and closes 366° after the first top centre. The usual cam-shaft in four-cycle engines revolving at one half crankshaft speed will in the case of the valve under consideration revolve therefore but $72\frac{1}{2}^{\circ}$ in. and 183° at the opening and closing of the valve respectively. Further; a shaft revolving at one-fourth engine speed will have these points at $36\frac{1}{4}^{\circ}$ and $91\frac{1}{2}^{\circ}$ respectively, after the position corresponding to the first top dead-centre of the main engine. Referring to the sketch "C" figure I, of such a crank circle it will be seen that every 90° represents a complete revolution of the main crank and numbering the top centres as No. 1, No. 2, No. 3 and No. 4, it is evident that at top centres No. 1 and No. 3 injection of fuel must occur in the engine cylinder.

Therefore, $36\frac{1}{4}^{\circ}$ after each half revolution of the one-quarter speed shaft, exhausting will commence and at $91\frac{1}{2}^{\circ}$ after each half revolution it should close.

In the sketch "C" the arcs are indicated during which periods the exhaust and inlet valves are open, as is required to synchronize with the strokes of the engine piston. Project these arcs horizontally on to the diameter as shown. Consider the vertical diameter to represent the length of travel of a rod reciprocating in suitable guides and carrying a cam. It is obvious that the cam may be designed to actuate a push-rod carrying a roller so as to provide proper motion to open and close the valve in the periods shown.

Upon the return stroke of the cam-rod (the second cycle of the main engine) the cam will be required to actuate the valve at that portion in the stroke corresponding in period to that of the first stroke. Thus it is seen that on the down stroke the cam will operate the valve for the 1st, 3rd, 5th, etc., cycles and up-stroke, for the 2nd, 4th, 6th, etc., cycles. The mechanical problem of alternating between two positions at which the cam shall act upon the roller and push rod does not seem to present very great difficulties. For purposes of illustrations, a direction of rotation was chosen as clockwise, in the sketch of the one-quarter speed shaft. However the cam action or travel will not be disturbed upon reversing. The straight line travel of the cam and its position in the stroke for a given angle of revolution either way from the top centre is the same. The application of this principle to the air-suction valve is the same.

There is a slight change in the relation of the position of the reciprocating cam-rod to the engine piston in the case of the fuel-injection and air-starting valves. With the exhaust-valve cam it will be noted that the ends of the cam-rod stroke were associated with the top centres No. 1 and 3 at which fuel-injection occurred in the engine. This arrangement results in action on the push-rod occurring during the mid portion of the cam-rod travel and not at the ends. Due to the unsymmetrical angles of valve opening and closing about the bottom centre of the main engine this was necessary, and requires the use of a two-faced cam. To obtain similar results

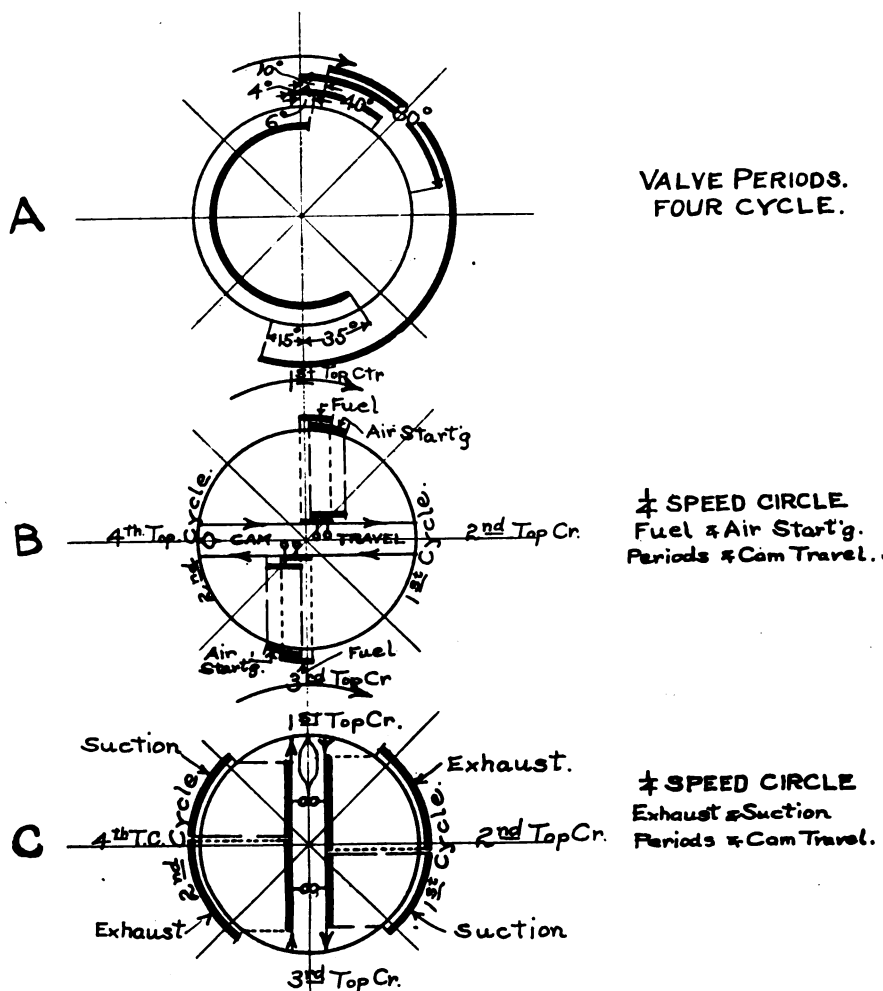
with the other valves the following relations between cam-rod and engine piston are necessary.

Fuel Injection

The cam-rod must be at its extreme position when the engine piston is at the top centres at which exhaust is about to be completed and air suction commence, or, in the sketch No. 2 and No. 4. Reckoning from this point on our original crank circle the fuel-injection begins and ends 356° and 400° of engine crank-angle respectively; or 89° and 100° after the extreme positions in the travel of the cam-rod. See sketch B in the illustration below.

Air-Starting

The relative positions of cam-rod and engine piston should be the same as with the fuel-injection. Thus the air starting valve should function between the points of travel of the cam-rod corresponding to the angles 366° and 440° or $91\frac{1}{2}^{\circ}$ and 110° of quarter speed revolution from the extreme positions. See sketch B in the illustration below.



Here the relative positions of cam-rod and engine piston should be the same as those of the exhaust-valve. Thus the same cam-rod may be used to carry the cams for these two valves as may also be done with fuel and air starting. Measuring angles from the first top centre for the opening and closing of the air inlet we see that the engine crank angles will be 370° and 560° respectively. On the cam circle they are $92\frac{1}{2}^{\circ}$ and 140° . See sketch "C."

In a two-cycle engine the mechanism of the cam gear should operate at one-half crankshaft speed and the applications will be similar to those in the four-cycle arrangement.

One feature of this type of gear is the slow speed at which it operates and the resultant low stresses and quiet running which could be obtained thereby.

FUTURE OF SOLID FUEL-INJECTION

The expression "solid" fuel-injection is of course to be understood as meaning the lack of any accessory in the matter of securing the minutes division of the fluid into a mist-like spray other than suddenly released pressure and proper mode of egress from the valve orifice.

The question is a detail of engine design which must eventually receive a great deal of attention both theoretical and practical. The liability and too often probability of air-compressor trouble is natural and quite correctly blamed upon the lack of experienced engine-room personnel. Nevertheless the most simple and surest method of doing away with these troubles; the always extra precautions needed with the high-pressure air-lines, valves, tanks, etcetera, seems to be to actually to do away with the need of generating such high pressures. The universal adoption of compressed-air for starting and manouevring need not be changed, for no great liability for trouble need be experienced in obtaining any quantity of air at two or three hundred pounds pressure.

The fundamental requisites to be fulfilled in obtaining sustained operation from a solid-injection system embrace more than merely obtaining a consistent uniformity in spraying action, and may be noted as follows: (1) to obtain a form of spray which will expose the maximum percentage of the oil spray to the

heated air for immediate combustion, (2) to maintain a clean nozzle at the completion of the injection and similarly (3) a complete and immediate pulverization of the fuel upon first entering the chamber, (4) an accurate control of amount and period of injection, (5) a localization of the high-pressure system of piping necessary for proper pulverization of the fuel.

First.—The proper form of spray for the introduction of the fuel calls for consideration. It is obviously desirous to obtain complete combustion without any particle of oil impinging on the walls or piston head. This will insure absence of carbon and prevent after burning during expansion and the consequent hot and even dirty exhaust. In a Diesel-engine the requisite pressure is reached with a compression volume of about 8% of that above the piston at the bottom centre. Thus with a large engine of say 30 inch stroke the depth of the combustion-chamber without valve pockets or dished piston-head is only about $2\frac{1}{2}$ inches.

Assuming a reasonable bore for this stroke of 24 inches we see the flat disc-like shape of the combustion chamber and the desirability of a wide angle for the entering spray is quite ob-

vious. The use of an inwardly opening spray-valve is well established and the continued adoption of this type seems probable.

The practice in the past to distort the piston-head and cylinder-cover to provide a shape of combustion-chamber suitable to the narrow coned-shaped spray usual with the needle-type valve, though it may prevent unburnt oil from reaching the walls of the chamber, does not seem to be the rational solution of the problem. The unequal heat stresses which are invited by these designs are liable to become much in evidence. Therefore, a very flat cone-shaped or even radial injection should be the best way to obtain immediate presentation of the maximum fuel surface to the action of the highly heated air of the combustion-chamber.

Second.—The clean condition of the lips or edges of the orifice after the injection of fuel is completed is vitally important to insure against fouling and accumulations of carbon with the consequent irregular pulverization of the oil. The problem of the spray-valve is recognized as being different from that of solid spraying of oil continuously as into the furnace of a steam-boller.

The intermittent action with its attendant variation in size of the aperture of the Diesel-engine spray-valve makes the problem much more difficult and little success, though some, has been attained without the use of compressed-air. The principle involved in the pulverization is mainly to overcome the surface tension of the liquid and break it up into minute particles. The fundamental conditions necessary to attain this result seem to be, that a violent turbulence should be experienced right at the same instant that the fluid oil experiences a sudden large decrease in pressure. With the air-spray this has been obtained—and let it be said that the setting up of such turbulence is perhaps the most important function that the air-spray performs.

In considering the process of combustion and injection it is evident that the first particles entering the combustion-chamber are thoroughly surrounded by heated air and burn promptly. That portion of oil which enters subsequently must of course be projected through the surrounding products of combustion without burning until they enter the adjacent portion of clean air at constantly increasing distance from the valve-orifice as combustion continues. Fuel-injection should therefore be anticipated along the lines of securing either an exchange of clean

air for burnt gases at the orifice or providing that the oil-spray be directed into all parts of the combustion-chamber so as to best secure equal pressure centres throughout the entire volume and thus prevent a sort of diluting action of the burned gases mixing with the as yet unused air.

The first method would involve extremely rapid and complete circulation of the entire volume of the combustion-chamber. The second method necessitates no circulation of the air in the chamber and the burning of each particle of the spray would be analogous to that of a burning object hurled through the air; always meeting a constant supply of fresh air for further rapid combustion. The point to be gained would naturally be to have the particles as projected entirely consumed just before they reached the walls of the combustion chamber and no sooner. These suggestions are made with the belief that the usual type of oil-spray from a needle-valve opening outward would not permit of proper combustion in the case of solid-injection.

Third.—The complete pulverization of the first particles of oil entering the combustion-chamber cannot be obtained without a provision being made to have this oil experience the same action of sudden and violent turbulence which the stream of oil following it will encounter. To have the oil under a heavy pressure and in a static condition and then merely to provide egress for it into a chamber of greatly decreased pressure will not result in the fluid bursting asunder of its own accord into the minute particles desired. This then means that the features of the valve designed to promote the breaking up of the liquid into a finely divided state must be on the combustion chamber side of the fuel-valve seat.

The first step in the process of breaking up of a quantity of liquid in a static condition must evidently be to impart to it a very high velocity. This it could attain while passing the valve seat and then as stated above this motion must be interfered with so violently that so much of the Kinetic energy possessed by the oil will be absorbed as is required to overcome the surface tension sufficiently to produce a finely divided spray.

Fourth.—Accurate control of the amount and period of fuel-injection is the important and not often well solved problem in attempting to

secure low-fuel consumption with any type of valve and with solid-injection the difficulties have seemed beyond solution.

Nevertheless it has been obtained quite satisfactorily in several designs. Considering the standard conditions prevailing for full-power injection, there are several ways in which a lesser quantity of fuel may be sprayed through the valve; namely, (1) To have a constant period of valve opening, with or without the immediate commencement of injection for all variations in the quantity of fuel delivered to the valve. (2) To provide a variable period of valve opening, which in itself controls and limits the amount of fuel used. In any event it seems desirable to provide a constantly maintained pressure on the fuel-oil during the period of admission and even extending an appreciable degree before and after the passage of fuel through the valve.

Fifth.—The localization of the high-pressure system seems to be desirable. This points to the possibility of developing locally for each injection the necessary pressure on the oil directly in the body of the fuel-valve caging. As an indication of the possibilities of this method it may be noted that a pressure of 3,000 lbs. per square inch may be developed and maintained by means of a spring loaded telescopic plunger rod of $\frac{3}{4}$ in. dia. by a pressure on the spring of 69.55 lbs. Such a rod could operate in a reservoir of fuel-oil which is in direct communication with the fuel-valve. If synchronized with the engine piston to develop the required pressure, immediately prior to the opening of the fuel-valve, considerable simplicity and dependability could be attained.

However, when all is said it seems evident that the success of solid fuel-injection even with medium heavy-oils depends principally on the ability of the valve to keep itself clean at the edges of the seat and orifice, and to provide immediately complete pulverization at the beginning of injection as well as to maintain that result to the last particles that issue from between the valve and its seat at cut off. With the heavy tar-oils the requisite fluidity must be obtained by sufficient preheating under pressure as to prevent the formation and separation of carbon particles from the body of the fluid which would clog up the strainers, valves, etc., and play havoc with the atomizing adjustments.

[Another interesting technical article by Mr. Karr will follow in an early issue.—Editor.]

DESIGN FOR A MOTOR TRAWLER

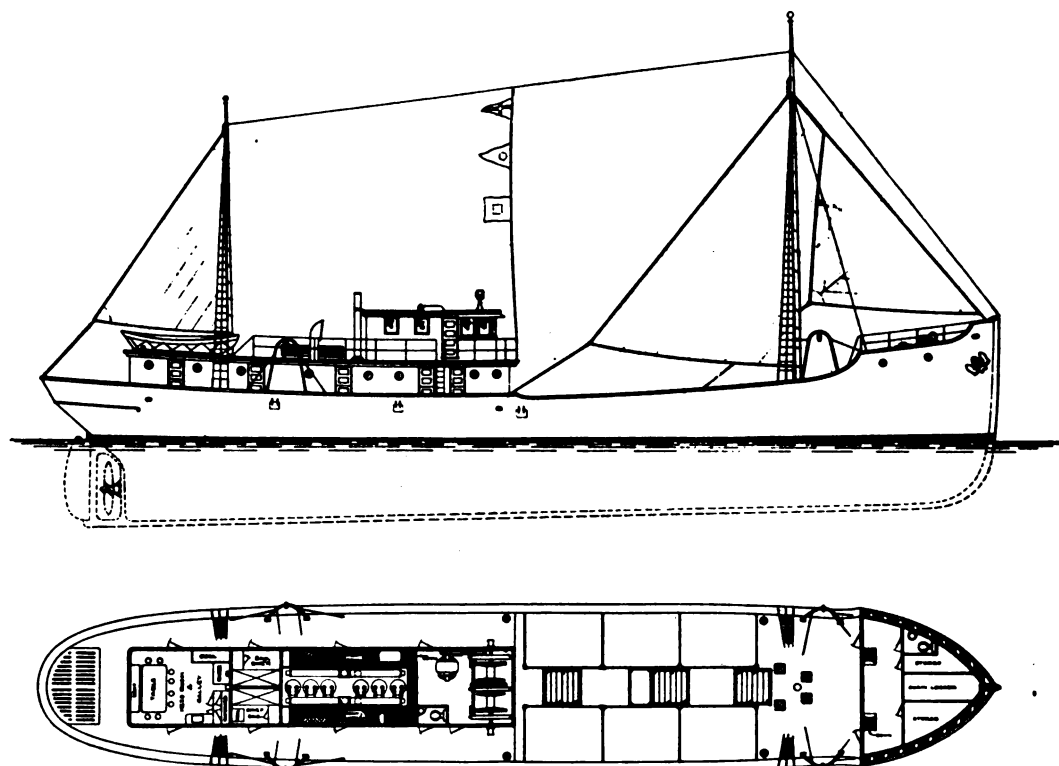
The plans herewith show the outboard profile and deck arrangement of a motor trawler designed for a New England fishing concern by E. A. Edwards, naval-architect of the Edwards Engineering Co., of Philadelphia. The vessel is of wood construction, built to American Bureau of Shipping requirements and powered with a 6-cylinder, 16 $\frac{1}{4}$ in. x 22 in., 4-cycle marine heavy-oil engine, which develops 425 B.H.P. at 190 R.P.M. and can be speeded up to 225 R.P.M. and 500 B.H.P. if desired. This plant is expected to give the boat a speed when loaded of 10 to 11 knots under all ordinary conditions. The auxiliaries are all electrically operated by direct-connected D.C. motors, the current being furnished by two or possibly three, oil-engine driven generating sets. One of the latter will be a 100 H.P. 75 K.W. outfit used only for the trawl winch and the other one or two sets will have a total of about 15 K.W. for pumps, auxiliary air-compressor, windlass, lights and storage battery charging.

The main engine has a fuel-consumption guaranteed not to exceed 0.43 lbs. per B.H.P. hour which will give the vessel a cruising radius of about 18 days at full speed on a bunker capacity of 15,000 gals., after making due allowance for fuel consumed by auxiliaries.

The principal dimensions of the trawler are as follows:

Length, O. A.	133 ft. 2 in.
Breadth, extreme	23 ft.
Depth of hold	13 ft.
Capacity (iced fish)	150 tons
Shaft, H.P.	425-500
Speed	10-11 knots

The great advantages of this type of vessel over the steam-driven trawler are apparent when it is realized that a coal-burning vessel of the same displacement and speed could not carry more than 7 days fuel supply and probably not more than three-quarters as much cargo. The motor-vessel requires only three men in the engine-room crew, while the steamer would have to carry at least two firemen and possibly three. Altogether the cost of operation will figure up to about half of the steam trawler of equal earning capacity.



150 tons oil-engined trawler designed by Edwards Engineering Co. of Philadelphia, Pa.

ARMSTRONG-WHITWORTH SUBMARINES

During the last year several large submarines were completed by Sir. W. G. Armstrong, Whitworth & Co., at their Elswick, Walker & Armstrong naval shipyards. Six submarines were placed in service including one of 1500 tons gross, and one of 1160 tons gross. They are of high power and speed.

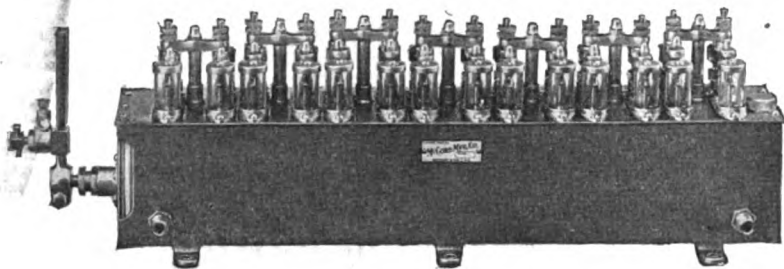
"PAPER ON THERMAL EFFICIENCY"

Sir Dugald Clerk, K.B.E., F.R.S., will write a paper on the Limits of Thermal Efficiency in Diesel and other internal-combustion engines at the general meeting of the North East Coast Institution of Engineers and Shipbuilders which will be held at Bobec Hall, Newcastle-upon-Tyne, England, on March 25th.

MCCORD LUBRICATORS NOW STANDARD ON NELSECO DIESEL ENGINES

After exhaustive tests of various types and makes of lubricators, the New London Ship and Engine Company has standardized on McCord Force Feed Lubricators which have been used by the Government on torpedo-boat destroyers, submarines, submarine chasers, etc., during the war.

Their unit construction permits the removal for inspection of individual pump units without disturbing the set regulation of other pumps. The ratchet drive of this lubricator is located inside the reservoir and runs in oil; while unusually large sight feeds, and the fact that the McCord will not corrode in salt water service, are other big factors of McCord design.



McCord Class "B" 14-feed lubricator

There are two designs for marine service known as Class B and Class R. The former is used on large internal-combustion engines, such as the Diesel type, where the oil must be delivered against great pressure (up to 4,000 lbs. per square inch), and regained to hold against vacuum. The Class "B" Lubricator consists of a cast-iron reservoir containing pumps or units which vary in number with the number of oil feeds desired, there being one unit for each feed.

The drawing shows a cross-section of the Lubricator through one of the pumps or units. Each unit consists of a cast body hung from the top of the reservoir, containing two pump plungers, connected at the top by a cross-head and actuated vertically by another cross-head attached to the stroke-shaft, which in turn is driven by the eccentric. This eccentric is revolved by a ratchet mechanism located at one end of the interior of the reservoir and driven by a shaft extending through a stuffing box to the exterior.

In operation the primary plunger on its upward stroke draws the oil from the reservoir through the intake, and on its downward stroke delivers it to the sight feed, whence it is drawn by the delivery plunger on its upward stroke and forced to the point to be lubricated by the downward stroke of same. The amount of oil delivered by each plunger is entirely dependent on the length of stroke which is regulated by the adjusting nuts, shown just above the driving yoke. The lower these adjusting nuts are set, the longer the stroke of the plungers, and consequently the greater delivery of oil.

The McCord Class "R" Force Feed Lubricator was designed for service where delivery of oil against high pressure is not required and where compactness and neatness are essential. The average pressure against which it delivers oil is about 100 lbs. per square inch. It is very largely used on gasoline marine motors, such as the Seabury, Standard and Regal.

It should be noted that ratchet drives may be located at either end of the reservoirs. The rotary drive may be located in any one of many positions as shown, and rotates in either direction. The pumps may be arranged in two compartments to feed different grades of oil.

NELSECO-DIESEL ENGINES BUILT IN GREAT BRITAIN

During the war a number of marine Nelseco-Diesel type engines of 240 b.h.p. have been built in Great Britain for the British Admiralty from designs by the New London Ship & Engine Co. of Groton, Conn. Most of these engines were built by Ruston & Hornsby of London, England. They are of the four-cycle type in eight cylinders and turn at 375 revolutions per minute. The firing sequences are as follows:—

Port Engine 1, 6, 2, 4, 8, 2, 7, 5.
Starboard Engine.... 1, 5, 7, 3, 8, 4, 2, 6.

These settings allow of any section of crankshaft fitting an engine of either hand, each engine having its crankshaft in two sections, with cranks at 90 degrees to each other.

British Admiralty tests show that the average cylinder-compression pressure is 470 lbs. per sq. inch and the firing pressure 500 lbs. when at

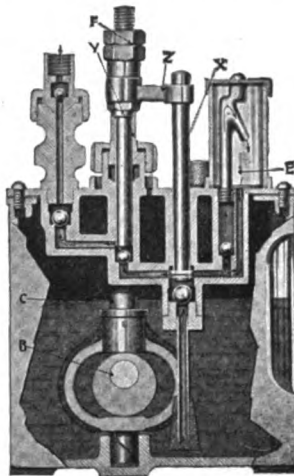
375 R.P.M. The following is from an Admiralty supervised test report, and there is a big reserve of power, although the exact overload was not determined.

Duration of trial.....	6 hours	6 hours
Revs. per min.....	382	378
Brake horse power.....	246	243.1
Fuel-oil lb. b.h.p. hr.....	0.488	0.47
Lubricating-oil gals. hr.....	0.33	0.33
Air throttle open max. 8 notches	2 notches	3 notches

Air-compressor—

Ford. 1st stage lb. sq. in.....	75	85
Aft 1st stage lb. sq. in.....	80	73.3
2nd stage lb. sq. in.....	1020	1000
Blast air lb. sq. in.....	1020	1009

Lub. oil pressure lb. sq. in.....	3.5	4.77
Circulating water lb. sq. in.....	3.0	5.0
Circulating water inlet deg. F.....	40	46
Circulating water outlet deg. F.....	80	88
Lubricating oil inlet deg. F.....	85	72.5
Lubricating oil outlet deg. F.....	90	84.6
Atmosphere deg. F.....	51	47
Crankcase deg. F.....	112	99
Fuel oil used—American distillate.		
Specific gravity—0.88 at 60 deg. F.		
Flashpoint—183 deg. F. (Abel test).		
Lubricating oil used—Vacuum D.T.E.		
Mean M.E.P. lb. sq. in.—114.		
Mean I.H.P. per cylinder—43		
Mean B.H.P. per cylinder—30.25.		
Mean mechanical efficiency per cent.—70.4.		



Cross section view of Class "B" lubricator

Valve Settings

10 degrees before T.D.C.—Spray valves opens compression stroke.
15 degrees before T.D.C.—Inlet valves opens exhaust stroke.
32 degrees after T.D.C.—Spray valves closes firing stroke.
140 degrees after T.D.C.—exhaust valves opens firing stroke.
200 degrees after T.D.C.—Inlet valves closes compression stroke.
12 degrees after T.D.C.—Exhaust valves closes induction stroke.
At T.D.C. air-starting valve opens.
Period of opening of spray valve equals 215 degrees.
Period of opening of inlet valve equals 42 degrees.
Period of opening of exhaust-valve equals 320 degrees.
Period of opening of air-starting valve equals 75 degrees.

The mechanical efficiency, cannot be taken as exact, as the gear provided with which to indicate the engines was most unsatisfactory, making it practically impossible to obtain a good card. Hence this and the I.H.P. must be taken as approximate.

A COMMENT ON THE SHIPPING BOARD'S NEW CONSTRUCTIONAL PROGRAM

The exposition just issued by the Department of Operations of the United States Shipping Board regarding future shipbuilding invites careful contemplation upon the feature of space and weight requirements of the propelling machinery, since some of the new types of ships are recommended to be driven by quadruple expansion steam engines at a sea speed of 13 knots. Outside of technical objections which give rise to some doubt as to the advisability of using such engines in this particular application, their bulk and weight, in addition to the great quantity of fuel these boats will have to carry for the specified steaming radius even in spite of their improved economy (about on a par with that given above for the turbine), will impose enormous commercial disadvantages.

Compared to a twin-screw Diesel installation of similar combined capacity, these disadvantages are so pronounced that it would be little short of a calamity to undertake construction of such steamers on an appreciable scale at so late a date. Even if such action should suggest itself by the possibility of production on a somewhat quickened schedule, this advantage is of so momentary a nature that it fades into significance in relation to the broad issue of bringing into existence an economical American merchant marine. From the viewpoint of national expediency, the early and unprejudiced recognition of the Diesel engine in the various forms in which it has proved to be feasible is the only path open whereby to reach our goal.

Fortified with a mass of valuable experiences which extend back over almost ten years of practical marine work, we are to-day in a position to build Diesel engines without any question as to their technical success.—H. R. Setz in "International Marine Engineering."

"LA VIE MARITIME ET FLUVIALE"

Our shipping readers will be interested and pleased to learn that the French marine journal "La Vie Maritime et Fluviale" will shortly renew publication. Subscriptions may be sent to Mons. Jean Vu Houget, Editor, "La Vie Maritime et Fluviale" 94 rue d'Amsterdam, Paris, France.

DEFINITION OF THE TERMS DIESEL AND "SEMI-DIESEL"

At a recent meeting of the Diesel Engine Users Association (London) a discussion took place on the *Definitions of Diesel and "Semi-Diesel" engines* respectively. There was some criticism of the use of the term "Semi-Diesel" as applied to hot-bulb or hot-surface ignition oil-engines; but, general opinion expressed was that although the expression "Semi-Diesel" might not be in every way desirable it was preferable to use a name which was well understood and fairly simple, sooner than to use a more cumbersome nomenclature which might be more strictly correct. As a result of the discussion the following definitions were approved:

Definition of a Diesel Engine.—A Diesel engine is a prime mover actuated by the gases resulting from the combustion of a liquid or pulverized fuel injected in a fine state of subdivision into the engine cylinder at or about the conclusion of a compression stroke. The heat generated by the compression to a high temperature of air within the cylinder is the sole means of igniting the charge. The combustion of the charge proceeds at, or approximately at, constant pressure.

Definition of a "Semi-Diesel" Engine.—A "semi-Diesel" engine is a prime mover actuated by the gases resulting from the combustion of a hydrocarbon oil. A charge of oil is injected in the form of a spray into a combustion space open to the cylinder of the engine at or about the time of maximum compression in the cylinder. The heat derived from an uncooled portion of the combustion chamber, together with the heat generated by the compression of air to a moderate temperature, ignites the charge. The combustion of the charge takes place at, or approximately at, constant volume.

"Motorship" is of the opinion that the above Diesel engine definition would have read more correctly if altered as follows, viz.: "A Diesel engine is a prime mover actuated by the expansion of burned gases resulting from—etc."

As regards the term "semi-Diesel," this has been abandoned in the United States, as it conveys no real conception of the system of operation of any engine thus termed. The so-called "semi-Diesel" engines include hot-bulb, hot-tube, hot-plate, and hot-ball types. Consequently, the term "surface-ignition engine," which covers all these, has been adopted as standard practice in America. British makers entering this market would do well to adopt this descriptive term, which, by the way, we believe was originated by Mr. Ernest W. Petter, of Petters Ltd., Yeovil, England. The entire subject was fully discussed in the February and March, 1917, issues of "Motorship."

FOUR VOYAGES OF THE WOODEN AUXILIARY SCHOONER "SHEREWOG"

The Work of Another Winton-Diesel Driven Ship

WE have before us an instance of another American-built wooden motorship equipped with American-constructed Diesel engines that is giving successful service. This is the twin-screw auxiliary schooner "Sherewog," built on the Atlantic coast at Savannah, Ga., by the Savannah Engineering and Construction Co. Her owners are R. Lawrence Smith, Inc., of New York. The following are the dimensions of this vessel:

Carrying capacity.....1500 to 1700 tons
Length.....226 ft.
Breadth.....40 ft.
Depth of Hull.....18 ft.
Power.....600 B.H.P.
Engine speed.....210 R.P.M.
Make of engines.....Winton-Diesel
Dimensions of engines.....Six-Cyls. 12 15/16" x 18"

Although this vessel was built as an auxiliary, her canvas seldom is used, the ship relying entirely upon the power-plant for propulsion. She started on her first trip on July 6, 1918, and has made the following four voyages:

AMERICAN AUXILIARY SCHOONER "SHEREWOG"

Voyage No. 1—Savannah, Ga., to Sabine, Texas, from Sabine, Texas, to Baltimore.

Actual running time 20 days and 6 hours. Number of knots—3282. Average number of knots, 164 per day.

Voyage No. 2—Left Baltimore, stopped at Newport News, Va., Brunswick, Ga., Havana, Cuba, Sabine, Texas, and returned to Baltimore.

Total number of knots—3782.

Total number of days under way—23 days—6 hours or an average of 165 knots per day.

Voyage No. 3—From Baltimore, Md., to Newport News, Va., from Newport News to Cienfuegos, Cuba; from Cienfuegos to Sabine, Texas, and from there back to Baltimore.

A total distance of 4422 knots.

The actual running time was 22½ days and speed averaged was about 196 knots per day.

Voyage No. 4—From Baltimore, Md., to Norfolk, Va., from Norfolk, to Port Arthur and from Port Arthur to Beaumont, Texas.

Running time—10 days and 2 hours or an average speed of 166 knots per day.

On the second and fourth voyages this vessel experienced some rather heavy weather and conditions were quite unusual. On the third voyage conditions were very favorable and the weather was unusually good, as can be determined from the log and number of miles this vessel cruised.

As we write she is loading at Beaumont, Texas, for Brest, France.

MOTOR TANKER GIVES GOOD SERVICE

The New Model Kahlenberg Engine

In service in the South is the little tanker "Captain Collier," owned by the Gulf Refining Company, at Jacksonville, Fla. This craft is about 100 ft. long and is propelled by two 100 b.h.p. Kahlenberg surface-ignition type marine heavy-oil engines. She is illustrated on this page. We also give an illustration of the four-cylinder 130 b.h.p. Kahlenberg marine oil-engine, built by the Kahlenberg Bros. of Two Rivers, Wis.

It is built along the general lines of all other engines of this make, and can be operated when running at slow speed without using the torches; the latter only being used for heating the ignition-bulbs when starting. But no electric spark is utilized. By means of the new patented air-reversing mechanism, the engine can be made direct-reversible. All that is necessary is to pull the air-throttle lever either to the forward or after end of the quadrant, depending upon in

which direction the engine is desired to run. Provided there is compressed-air in the tanks the reversing can be handled in this manner.

Messrs. Kahlenberg Bros. Co. recently shipped one of these engines to the State of New Jersey, and have shipped another for a tug-boat on the Wolf River. A 50-h.p. engine and one of 100 h.p. are installed in boats owned by Mr. Ramon Aboltiz of Cabus, Philippine Islands.

In the 54-ft. tug "Frank Weston," owned by the Soo Towing and Rafting Co. of Sault Ste. Marie, Mich., a 100-h.p. Kahlenberg engine is doing hard work handling lighters and rafting; including a 7 days' winter trip up the North Shore of Lake Superior, searching for traces of the lost French trawlers. Mr. H. Pita, of Caibarien, Peru, says that his tug-boat, in which he installed a 70-h.p.

discussed in the columns of "Motorship." The dimensions of the above two vessels are as follows:

	M. S. "Suecia" S.S. "Princess Ingeborg"
Displacement.....	9,625 tons.....8,660 tons
Length.....	362 ft.....360 ft.
Breadth.....	50 ft. 3 ins.....48 ft. 9 ins.
Depth.....	26 ft. 2 ins.....25 ft. 6 ins.
Indicated H.P.....	2,600 H.P.....2,420 H.P.

The steamship obviously is a finer-lined boat, is smaller, but of almost similar horse-power. Because of the difference in the fuel-consumption and water-consumption, the displacement of the steamer became about 28 tons less every day, but the daily reduction in displacement of the motorship was only about 8 tons.

Recently the steamship "China" made a voyage lasting 2,517 hours, and the motorship "Siam"



The Kahlenberg-engined vessel "Captain Collier"

Kahlenberg engine last year, tows ships of more than 500 tons a distance of 50 to 60 miles with very satisfactory results.

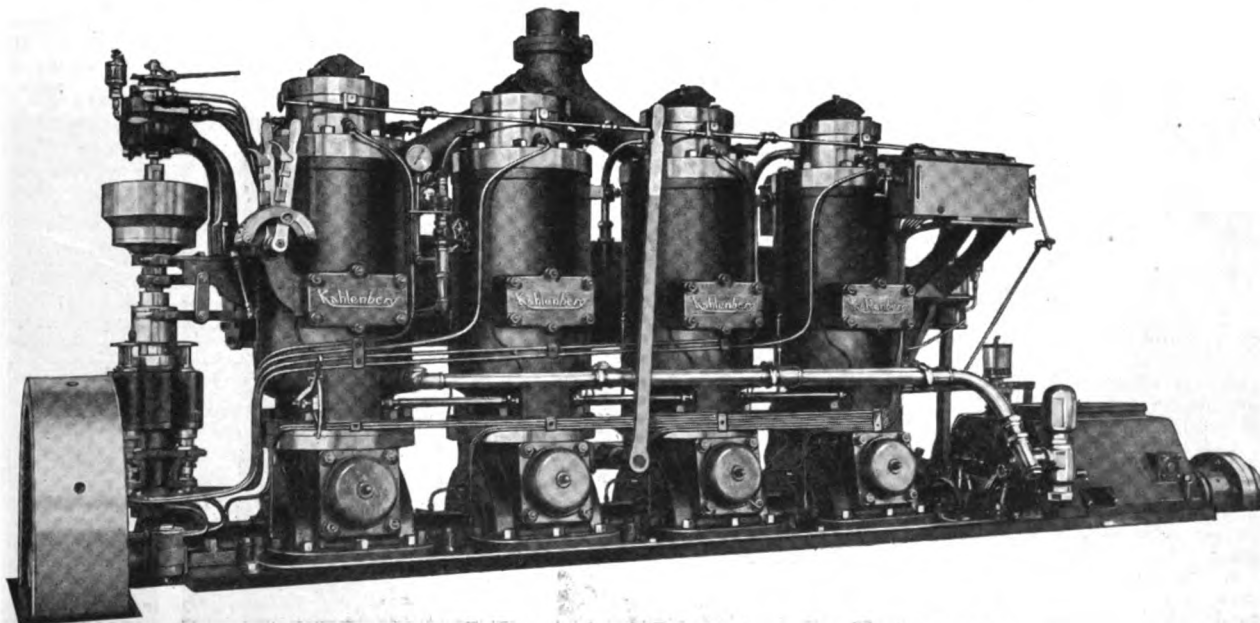
MOTORSHIPS VERSUS STEAMSHIPS

Comparisons on Same Voyages

Recently the motorship "Suecia" and the steamship "Princess Ingeborg" made voyages from Europe to South America and back at the same time. Both on the outward and home voyages the Diesel-driven vessel arrived two days ahead. This was accounted for by the absence of propeller racing in the case of the motorship, although in the steamer an engineer was stationed at the throttle in bad weather, whereas, with the motorship, the governing is automatic and instantaneous. This advantageous feature has previously been

made a voyage lasting 2,497 hours. The cost of carrying each 1,000 tons of cargo worked out at 12 cents and 4 cents per nautical mile, respectively, at 11 knots speed. This resulted in a saving in fuel due to the oil-engines of \$20,215.00 for the voyage, or fuel economy of 68 per cent. and of course the motorship carried much more cargo.

These vessels are of much the same size. It is to be noted that the S.S. "China" manoeuvred for 92 hours compared with 82 hours for the M. S. "Siam." For banked fires and for getting-up steam the steamship used 90 tons of coal, compared with none at all by the motorship. The steamship also used 179 tons of coal for the winches and pumps compared with 23 tons by the motorship. The distance run was 27,800 and 27,818 miles respectively.



The new 130 b.h.p. direct-reversible Kahlenberg marine heavy-oil engine

The Plastic-Arc System of Welding

An Interesting Technical Discussion of the Methods Employed

By J. O. SMITH

MANY are the uses for which electric welding can be employed in the construction and repair of motorships and their machinery, while in England the hull of a Diesel-driven motorship is being built by means of electric-welding, ordinary rivetting being dispensed with. Electricity as a means of the joining of metals, in repairing cracks or breaks, salvaging defective castings and for metal cutting purposes, all included under the general head of electric welding, although comparatively simple in theory, has been slower in development in this particular field than in any other service in which it has been applied. This slow growth is probably due to two causes—the scarcity of skilled operators and reliable apparatus suitable for performing the actual operation.

During the last two years, however, arc welding has made great strides, and undoubtedly a great stepping-stone, by means of which it has attained greater prominence and the confidence of the engineering world in general, was through the successful welding of the damaged parts of the interned German ships at New York at the outbreak of the war in the spring of 1917. The work that was done on the engines of the damaged German ships demonstrated to the engineering world in general that electric welding could be depended upon to make permanent repairs, no matter how large or bulky the part to be welded, or the character of the metal.

There are four general fundamental types of arc welding outfits in general use, at the present time—constant potential, with fixed resistance; variable potential, rising and falling inversely as the current rises and falls; constant current, all employing direct current, and the alternating current type, with reactive control.

The constant potential system is the oldest of the direct-current systems. It was originally designed, to work on a generator voltage of between 75 and 80 volts, but as later experiments and results clearly demonstrated that more satisfactory results could be obtained with a much lower voltage, this system has been redesigned to work on a generator voltage of 35, with 18 to 22 volts at the arc for actual welding.

Another distinct advantage of low voltage at the arc is that it becomes impossible for the operator to draw out a long arc between the electrode and the work. The deposition of clean sound metal resulting in a good weld is largely a question of the operator's skill in maintaining a short and even arc, which eliminates oxidation of the molten metal by the air and ensures the metal being deposited in the correct place. The voltage across the arc increases as the arc lengthens, and if the voltage is too low to maintain anything but a correct length of arc, it follows that the operator has a surer indication (when his arc begins to weaken) that he must shorten the distance between his electrode and the work. With a low-voltage supply the external appearance of a weld is a certain guide to its value, and it can be safely reckoned to be free internally from any dangerous slag or oxide inclusions.

The variable potential system, in which the current and voltage balance one another to a certain extent, the current varying principally with the length of the arc, and maintaining its greatest stability when the arc is of considerable length. The long arc, however, is not generally advocated, because of heat diffusion at the surface of the original metal, and because of the tendency of the original metal to become porous and also to oxidize. The constant current system is used primarily for single arc outfits, although arcs in series can be used.

Owing to the alterations of the current, it is practically impossible to draw a long arc in the alternating current system and further, owing to the arc being more sensitive to variations in its length than in direct current systems, a higher voltage is necessary to steady it. Coated electrodes are used with the alternating system.

In the Wilson system which comes, of course, in the constant potential class, the power lost in the line and in the automatic current regulation is of low value compared to the energy actually required for welding, and there is, consequently, a great saving over other systems employing higher voltage. The low voltage used also insures better penetration of the original metal by the concentrated arc than is true when a longer, diffused arc of the higher voltage systems is used.

The comprehensive repairs necessary in the case of the damaged engines and other parts of the interned German ships definitely determined that any welding system, to be considered available

for such heavy work in cast iron or cast steel, must deliver and maintain a critical degree of heat at the weld, in order to insure proper fusing of the original and the added metal.

This condition is successfully accomplished in the Wilson System, which is in the constant potential class, by means of a standard flat compound 35-volt generator to feed a special constant-current controller. The carbon pile and a solenoid that operates the arc, are in series with it, so that the current through the arc is controlled by the automatic variation of the resistance of the carbon pile in response to the pull of the solenoid. The pull of the solenoid is balanced in turn by a spring connection from a leverage, and the current adjustment is made by changing the leverage. The pilot motor, which is controlled by a switch from at the welding-tool handle, regulates the leverage so that the operator can change the current at the arc, if necessary, without leaving his work or extinguishing the arc, a desirable feature in ship or general welding repair work.

In the case of the repairs to the damaged engines of the German ships, the nature of some of the breaks in castings is shown by the accompanying photographs which have been taken at various stages of the work, and from which a much more comprehensive idea of the extent of the damage can be gotten than by any other means.

Fig. 1 is the break in the starboard high-pressure cylinder of the ex North German Lloyd steamer "George Washington." This break was effected by boring a row of holes about an inch apart and knocking the piece out with a ram.

To prepare this for welding it was necessary to chisel off the surface only roughly, build a pattern of the break, cast a steel piece from the pattern, stud up the surface of the cast iron of the cylinder with a staggered row of steel studs five-eighths inch in diameter, projecting one-half inch from the cylinder, bevel the edge of the cast piece, place the piece in position as shown in Fig. 2, and make the weld. When completed, the appearance of the work is as it appears in Fig. 3. The broad belt of welded metal shown in Fig. 3 is due to the laying of a pad of metal over the rows of studs previously noted.

Tests have shown conclusively that the weld can be properly made without this pad; that is, if the approximate strength of the original metal is all that is desired—in which case the studding of the metal is unnecessary.

Fig. 4 shows a damaged high-pressure cylinder which has been prepared for welding, and Fig. 5 is the same cylinder after a new part, to replace the one broken out and thrown overboard had been welded in place.

Fig. 6 shows practically a whole new bottom was necessary in the case of the second intermediate pressure cylinder, and Fig. 7 shows this same cylinder after it had been welded and tested.

Fig. 8 is a damaged valve chest cover and Fig. 9 is the same part after repairs had been made by welding. The first steel-plate condenser ever welded throughout, and in the construction of which not a single rivet was used, is shown in Fig. 10. This type of condenser is of the type used on the torpedo boat destroyer. Welded fuel tanks for destroyers are shown in Fig. 11.

An anchor engine and part, repaired by the

Plastic-Arc Welder, are shown in Figs. 12 and 13. In Fig. 14 the adaptability of this system of welding to work in the interior of fireboxes, boilers, tanks and other confined spaces is clearly shown. Fig. 15 is an example as to how boiler tubes can be welded to a flue sheet.

In the early days of arc welding attention was directed solely to developing the machines employed in the operation and very little to the welding metal used, or how it should be used to attain the best welds. The result was that a large percentage of the attempted welds were failures, due principally to the change in characteristics of the welding metal from the effect of the heat of the arc.

This particular phase of welding was made the subject of special study by laboratory engineers of the Wilson Welder & Metals Company, of 2 Rector Street, New York; with the idea of developing a welding metal that would hold its proper characteristics through the intense heat of the arc. It was determined after long experiment that no one welding metal could be developed that would insure lasting holding qualities in welds on a variety of metals.

The result was that a number of special welding metals were developed and these were experimented with, analyzed and further developed until the special welding metals, known as Wilson Certified Welding Metals, were finally developed.

These special welding metals of which there are eight grades are in the form of bare welding electrodes.

In order to insure proper tensile strength and ductility it is necessary that the welding metal possess the following qualities:

1. That the wire flow evenly with good penetration.

2. That the metal added will compare favorably in its composition with the parent metal.

In welding with a soft ordinary iron electrode on a metal part which contains about 20 per cent carbon and 45 per cent manganese, the deposited metal is practically pure iron and does not penetrate the weld. The parent metal is plastic about 3/16 in. below the surface and the electrode is added while it too is in plastic state. When a sufficient amount of this incorrect welding metal has been deposited at a certain point, the operator moves the arc along and the metal quickly hardens, leaving a sharp line between the parent and the added metal. The result is a weld without holding qualities or the tensile strength of the parent metal, and failure is bound to occur the first time undue stress is imposed on the welded part.

In order to insure tensile strength as great as that of the parent metal, it is absolutely necessary that the welding metal be of such composition as to retain the characteristics of the parent metal after the welding metal has been passed through the intense heat of the arc.

In welding parent metal of about 18 per cent carbon and 45 per cent manganese, by the Wilson System, No. 6 welding wire is used. This contains 22 per cent carbon and 75 per cent manganese, with a small amount of copper. Part of the manganese and some of the carbon and practically all of the copper is burned away in the arc, leaving the added metal with about 19 per cent carbon, 50 per cent manganese and no copper, which is approximately the same as the parent metal.

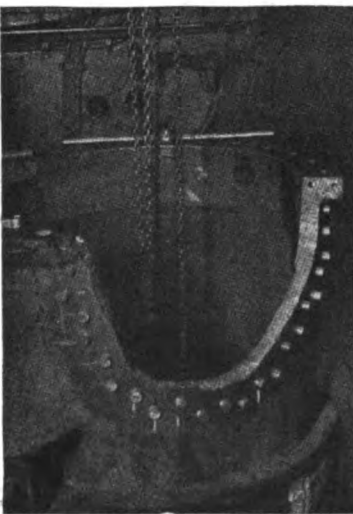


Fig. 1

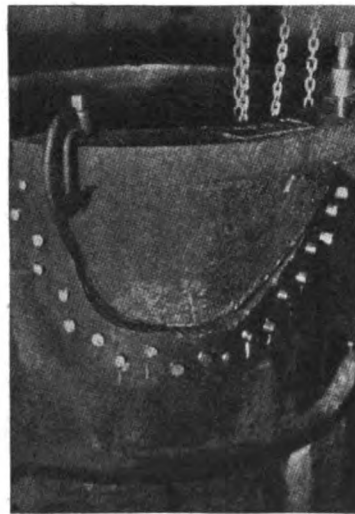
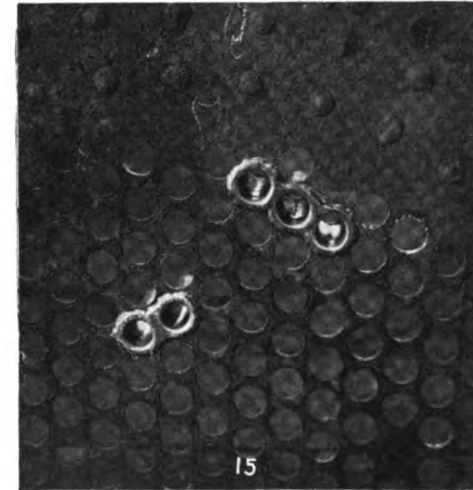
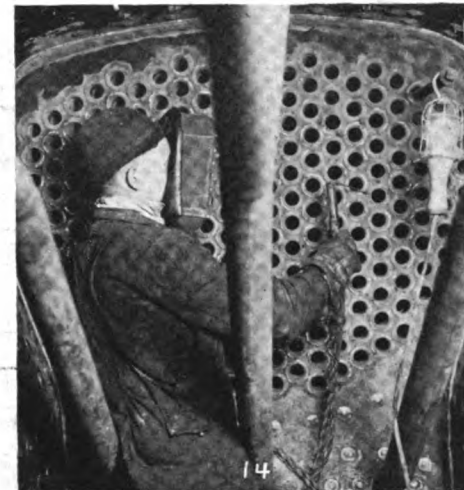
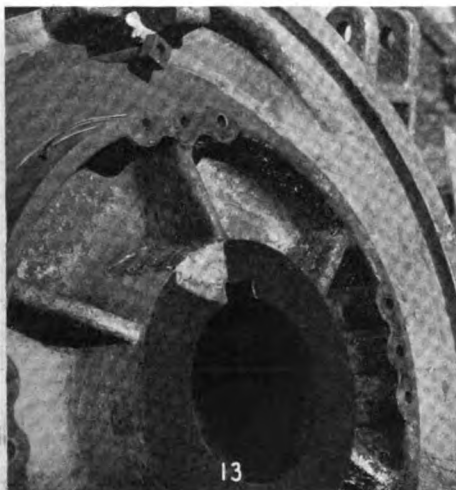
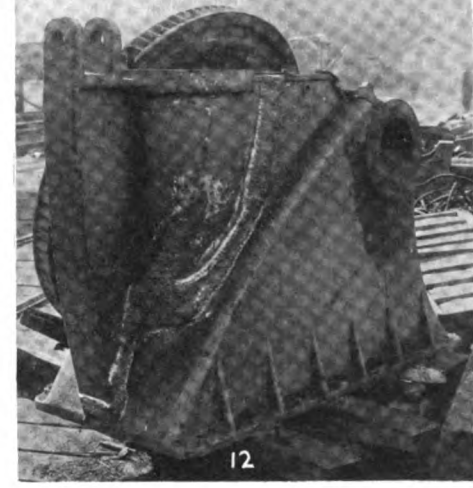
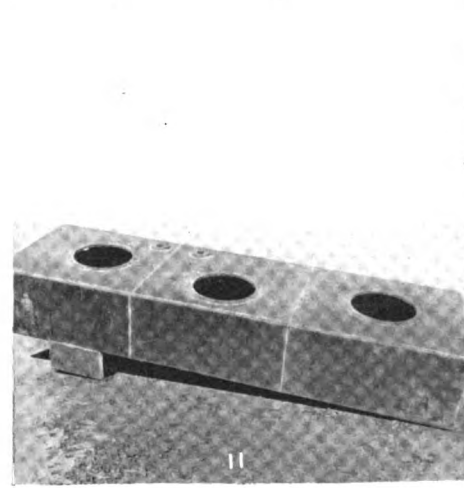
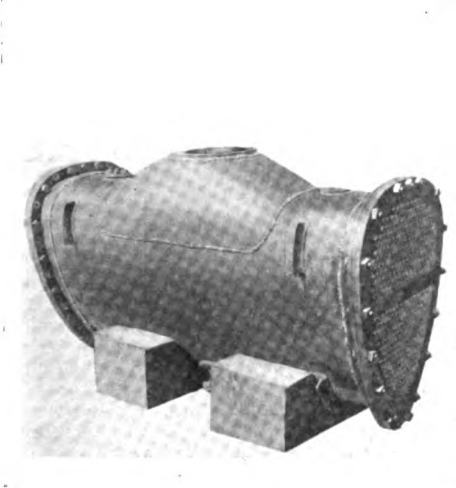
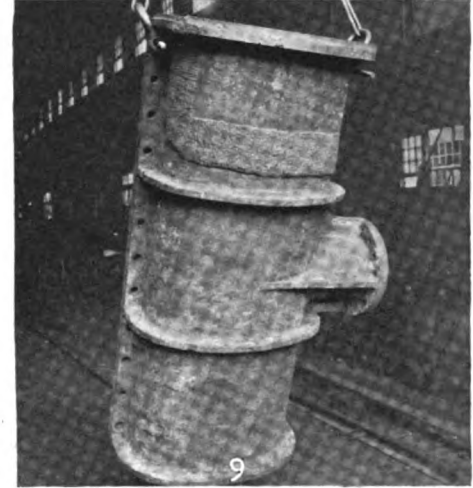
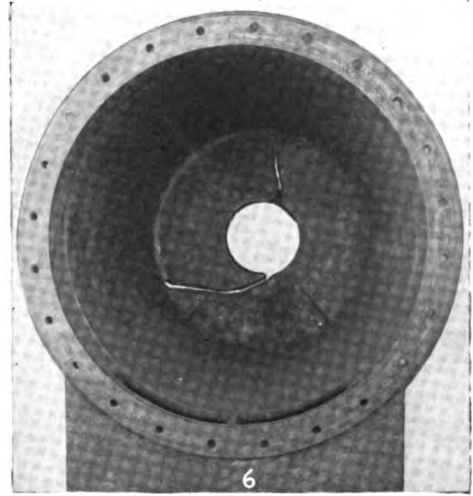


Fig. 2



Fig. 3



Why Have We Not Built More Large Diesel Engines?

By ALFRED GALL

[Mr. Gall is a Norwegian engineer, late of the Akers Yard, Christiania, and his views may be of interest.—EDITOR.]

WELL, let us blame the world-war for that. But, maybe, before long we will thank the world-war for going into large Diesel engine construction. Since "Motorship" started its fight in favor of Diesel engine propelled ships, there has come to the surface a good many old ideas, which can be criticized and will be contradicted.

Why have the smaller American built Diesel engines not been so good and reliable as they were expected? This question was put up to me by Mr. _____ of the U. S. Shipping Board, during my stay in San Francisco. My answer was, according to my knowledge under my two years' stay in different shops on the Pacific Coast, the Americans start with manufacturing "Diesel Engines"; the Europeans build them and up to the present time they have not started with manufacturing them. Every Diesel engine is tested out thoroughly and carefully, and if time permits, experimenting is made. But before a Diesel engine leaves the testing plant, it is completely finished and no changes are taking place while they are being installed abroad the ships.

It certainly is a great pleasure to build a piece of machinery which is so simple to operate as a Diesel engine, but of course, if the engine is not built right, it cannot be operated right. In this great country we have the finest precision tools of any country, and if a plant is laid-out right, with a system in manufacturing the different parts with the necessary accuracy, any decent mechanic can do the finishing. Under the present shop conditions too much is left to the shop to decide what to do and what to use.

We all know now the Diesel engine is far more cheaper to operate than a gas or steam engine; but it must not be forgotten or overlooked that it must be built more carefully.

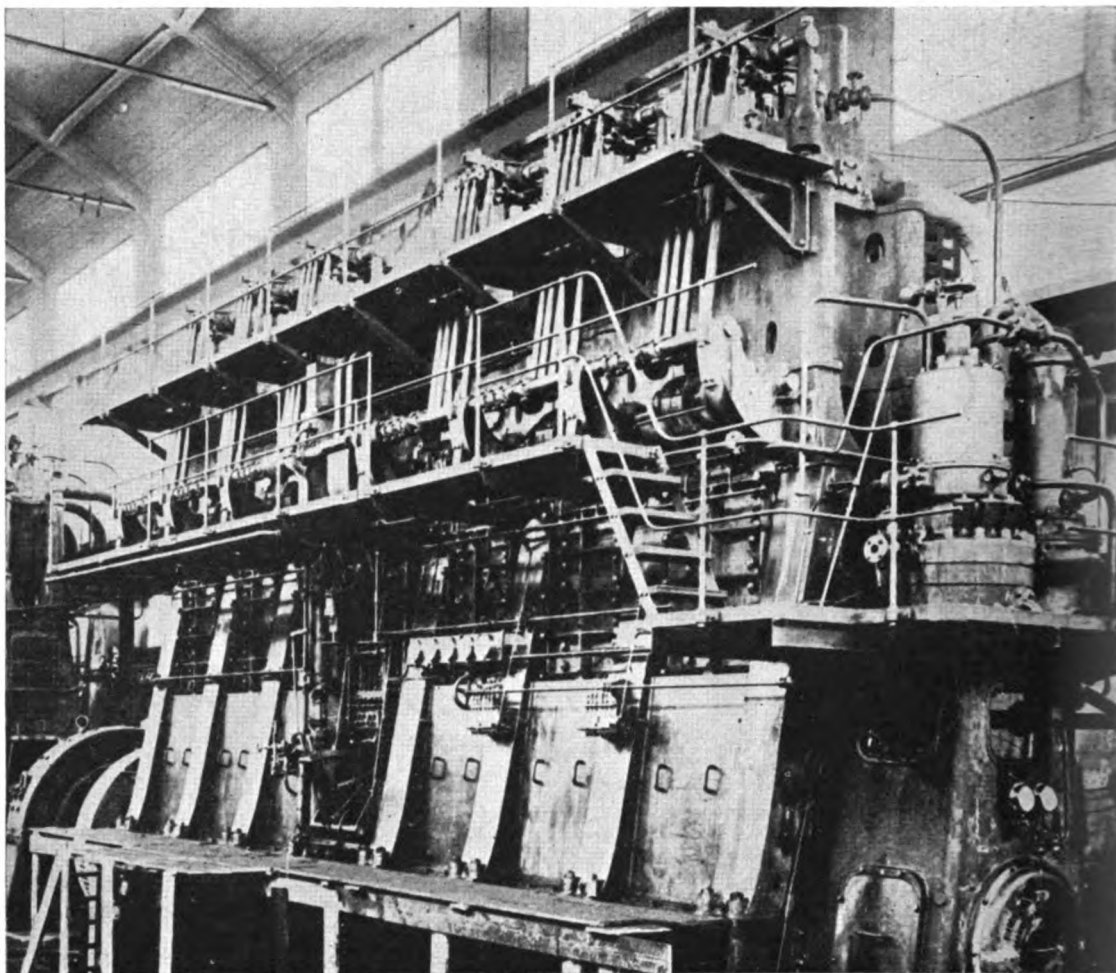
When the Akers Works in Christiania started building large Diesel engines a few years ago, they were up-against nearly the same thing as the shops out here. All drawings were in millimeters, something new to them—but as the millimeter system is far easier to use, it was easy for the workmen to get acquainted with it. This plant, which in normal times employs around 2,000 men, has for many years built steamships, special whale-fishing ships; but the building of the Diesel engines went thru' as smoothly as the run of the engines in the ships. Yet, we hear it said that we have no mechanics for building Diesel engines.

Another thing that must not be overlooked is, that the man who has charge of the different

departments, must be an absolute first class mechanic, even if he is not as good friends with those higher up as somebody else, if not, too many parts will have to be made over again when

found out is very beneficial in the operating of the Diesel engine—Do not keep anything secret, but get the men interested in what they are making. Thus you will get far better results, and the men know why carefulness must be used.

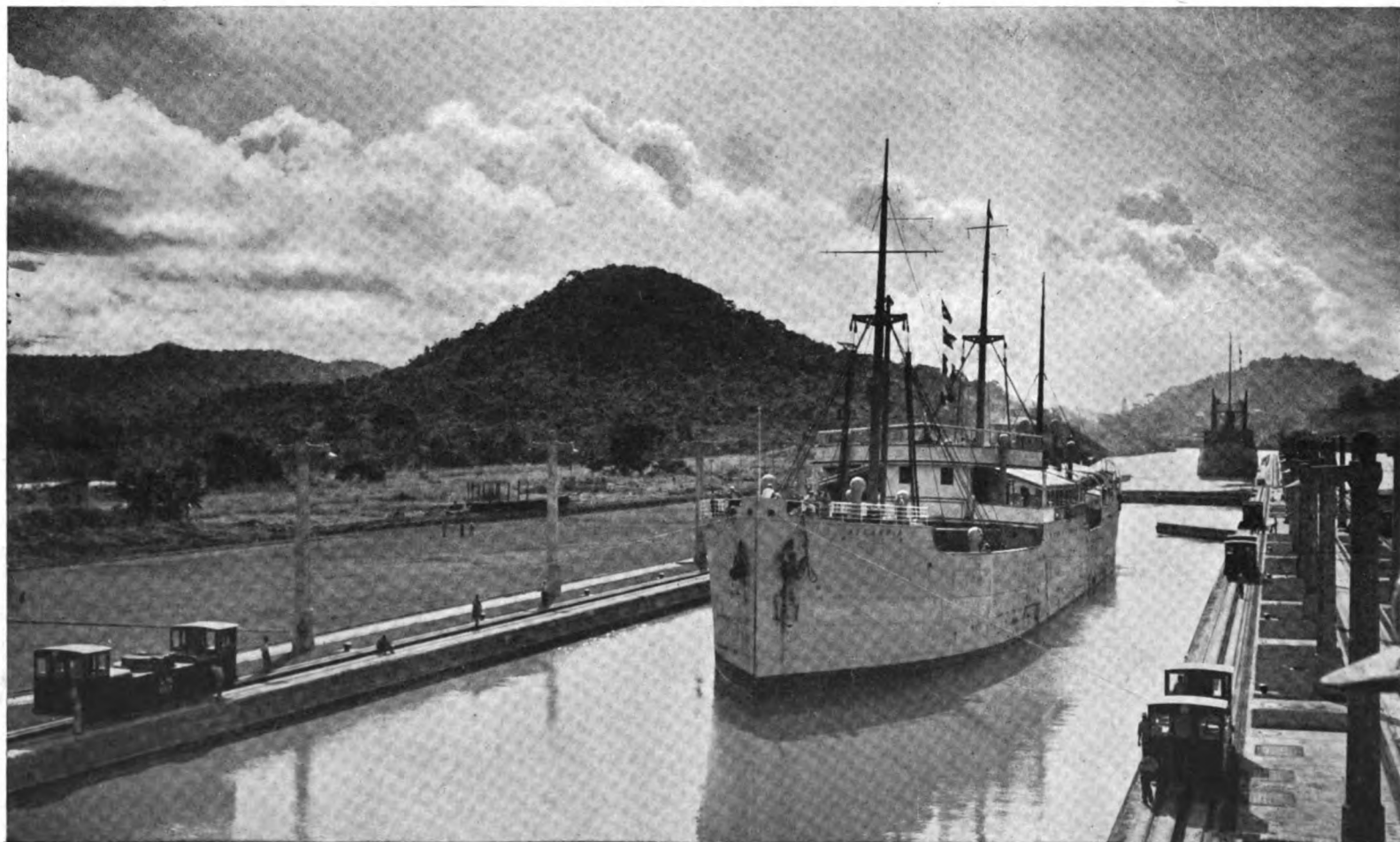
The American mechanic has this advantage over his fellows in the Scandinavian Country, he has his own hand tools, the man over there has in his possession very seldom more than a 3-foot rule, and the shop furnishes him only partly with



One of the B. & W. Diesel engines of the motorship "George Washington." See pages 22-23

they come to the Erecting plant, and that is only time and money wasted away, also poor workmanship results. Another thing I have

handtools. If, therefore, employers will not seek big profits until they get a good start, the success and profit then is sure to come.



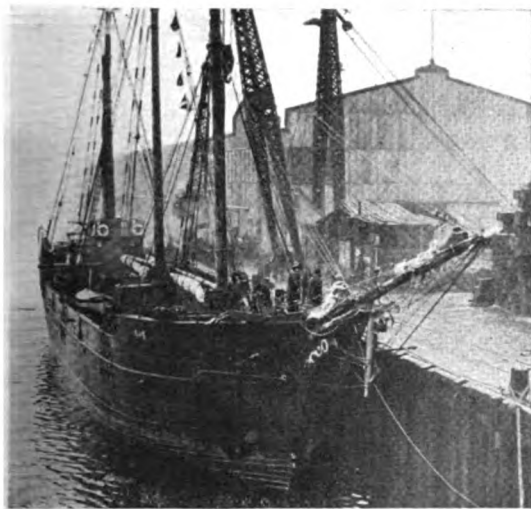
Motorship "Selandia" passing through Pedro Miguel Locks, Panama Canal

Oil Engines, Motor Fishing-Boats, and Motorships in Japan

Surprising Development of the Industry in the Land of the Rising Sun---Possible Competitor in Foreign Markets

A WOODEN three-masted schooner of about 500 gross tons recently entered Seattle harbor. She came in under auxiliary power with all sails furled, and flying the Japanese flag. She turned out to be the "Houzan Maru" and as far as is known is the first Japanese vessel of her class to visit the United States. A week later she was followed by a sister motor-auxiliary vessel, also from Japan.

Japanese have a world-wide reputation for copy-



The Japanese motor-auxiliary schooner "Houzan Maru" at Seattle, Wash.

ing successful developments, and investigation shows that they have made great strides in the construction of marine heavy-oil engines and motorships, and before long competition from Japanese shipowners on the Pacific ocean may be strongly felt by domestic shipowners in ports from Los Angeles to Seattle, and similar warnings have been repeatedly issued by "Motorship." Several of the older established steel shipyards in Japan have entered into the construction of high-powered Diesel engines under European licenses, also the Government has spent large sums of money in Europe—particularly the Admiralty—for Diesel licenses and for high-powered marine Diesel engines that they have imported from such well-known concerns as Sulzer Frères, Schneider et Cie, and Ansaldo (Ex-Fiat) San Giorgio. According to an official of the Toyo Kisen Kaisha of Yokohama, this well-known Japanese steamship owning firm are having built some Diesel-driven motorships of over 10,000 tons d.w.c.

However, it is not with Diesel engines that we propose to discuss in this article, but with the remarkable strides that have been made in the "land of the rising sun" with marine oil-engines of the surface-ignition type in connection with small trading-ships, coastwise-craft, fishing-boats, and auxiliary sailing vessels, which during the last few years have been turned-out in large numbers. Consequently the building of low-compress-

sion marine heavy-oil engines has become quite an important engineering industry in that country.

This industry has been strongly fostered by the Japanese Government, as also Diesel engine construction was fostered, and under the "Ocean Fisheries Bounty Act" any builder of ocean-going motor fishing-boats is paid a bounty of \$15.00 per gross ton on the boat itself and \$10.00 per B.H.P. on the oil-engine. It is not surprising that by the end of 1916 there were no fewer than 2,748 Japanese motor fishing-craft in service having an aggregate of 48,631 B.H.P., of which 1,569 boats were specially built. Later figures than 1916 are not to hand at the time of writing, but judging by the following table the number of motor fishing boats now in service probably exceeds four thousand.

In the early days of the Japanese motor fishing-

	1907	1908	Motor Fishing Boats in Japan	1911	1912	1913	1914	1915	1916
Total Number.....	7	21	1909	1910	1911	1912	1913	1914	1915
Total B.H.P.....	107	371	2,159	4,495	541	828	1,674	2,073	2,511
Average B.H.P.....	15.3	17.8	26.3	22.6	10,740	14,867	24,300	30,791	40,664
					19.8	17.9	14.5	14.9	16.2
									48,631
									17.7

boat industry, many American and European engines were imported—about ninety per cent of the business going to the Union Gas Engine Co. of San Francisco, Cal., but the Government's subsidy greatly encouraged domestic construction of oil-engines and most of these used a cheaper fuel than the distillate-oil, kerosene, or gasoline burned by the Union engines, which fuels were very expensive in Japan, consequently several years ago a number of boats so equipped were converted to heavy-oil engine power, Bolinder engines having been imported from Sweden for that purpose. Speaking from a general point-of-view there can be but little doubt but that the Union people would have retained more of this business than they have done had they developed and produced a heavy-oil motor. Their kerosene engine was a most excellent one, and very reliable, but, the heavy-oil engines enabled the fishermen to cut their operation costs in half and this was an important factor.

At that time there were practically no heavy-oil engines obtainable by Japan from the Pacific Coast of the U. S. A. and this fact added impetus to domestic construction, already fostered by Government subsidies. However, there still remains over three-hundred thousand fishing-boats in Japan in which power has not yet been installed, so there may be excellent opportunities to revive this old market, which still uses a limited number of American motors. Producer-gas generators and motors also are used in these fishing-boats, as coke is cheap compared with kerosene. American oil-engine builders could do worse than get into communication with Mr. T. Tajima of the Bureau of Fisheries, Tokyo, Japan, or with the experimental Fishery Station of the Shizuoka Prefecture, with a view to ascertaining the exact requirements and the possibilities of doing business in Japan at the present time.

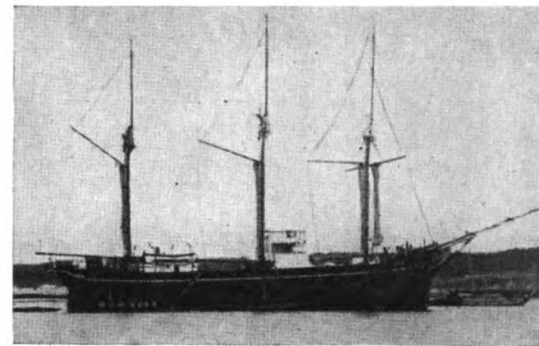
Among Japanese commercial marine oil-engines of the surface-ignition type is the Nishitani, built by one of the associated firms of the Mitsui Bussan Kaishi Ltd. of Tokyo. This engine is built in sizes from 2 B.H.P. to 1,000 B.H.P., and it is said

that many orders for motors of one-thousand horsepower each are in hand for coastwise and ocean trading-ships. This engine was designed by Mr. T. Nishitani, Manager, Nishitani Ironworks Ltd., Kobe.

Then there is the Ikegal surface-ignition oil engine, built by the Ikegal Iron Works Ltd., Shiba, Tokyo, who built the motor installed in the "Houzan Maru," the vessel referred to in the introductory paragraph of this article. They already have built these engines up to 300 B.H.P. in four-cylinders and are contemplating still larger sizes.

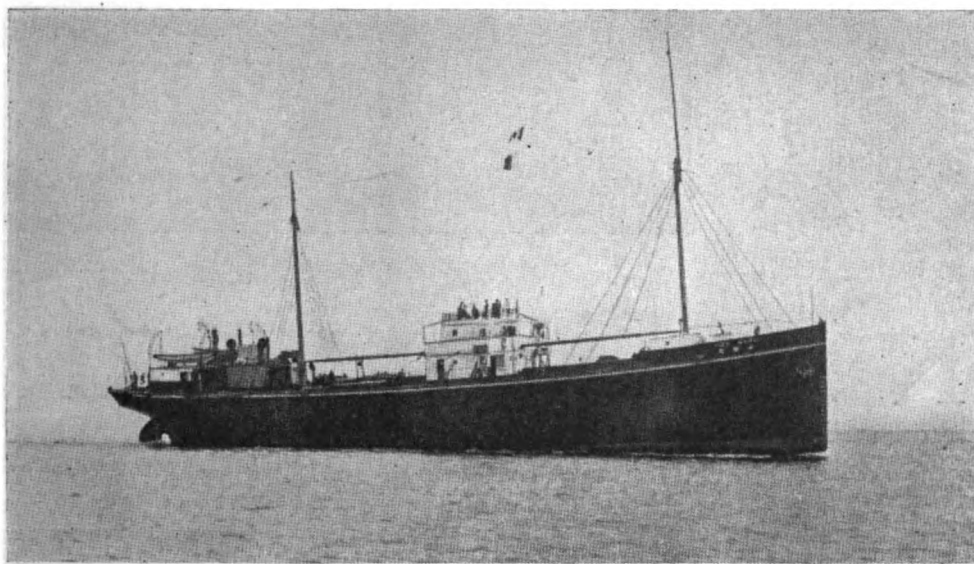
The "Houzan Maru" reached Seattle after a very stormy passage from Yokohama, bringing a cargo of stockfish. She was built last year at Shinagawos, Japan, for the Japan Fishery Com-

pany, which is engaged in fishery operations in the Okhotsk Sea and the Kanchatka Peninsula. She is a freighter rather than a fishing-vessel, and is a wooden three-masted schooner, somewhat similar in general design to a number of American vessels engaged in our own coastwise trade. She is a vessel of 485 tons gross, 135 ft. long, 35 ft. beam, with a draft of 17 ft. The report that she was built of American lumber is denied by the officers, who assert that the material is all of Japanese production. The bottom is copper sheathed, which is of particular importance to all vessels engaged in service in tropical water where the toredo-worm always exists.

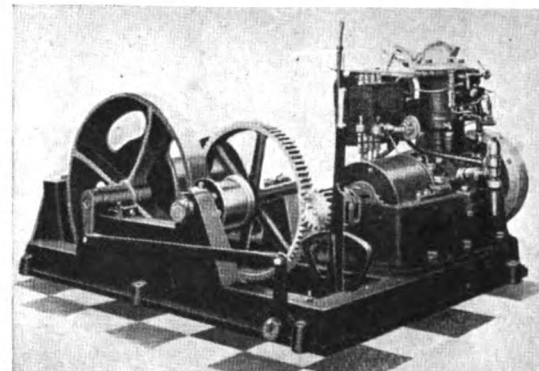


"Fumitsuki Maru No. 5," a Japanese auxiliary, powered with two 140 b.h.p. Niigata surface-ignition oil-engines

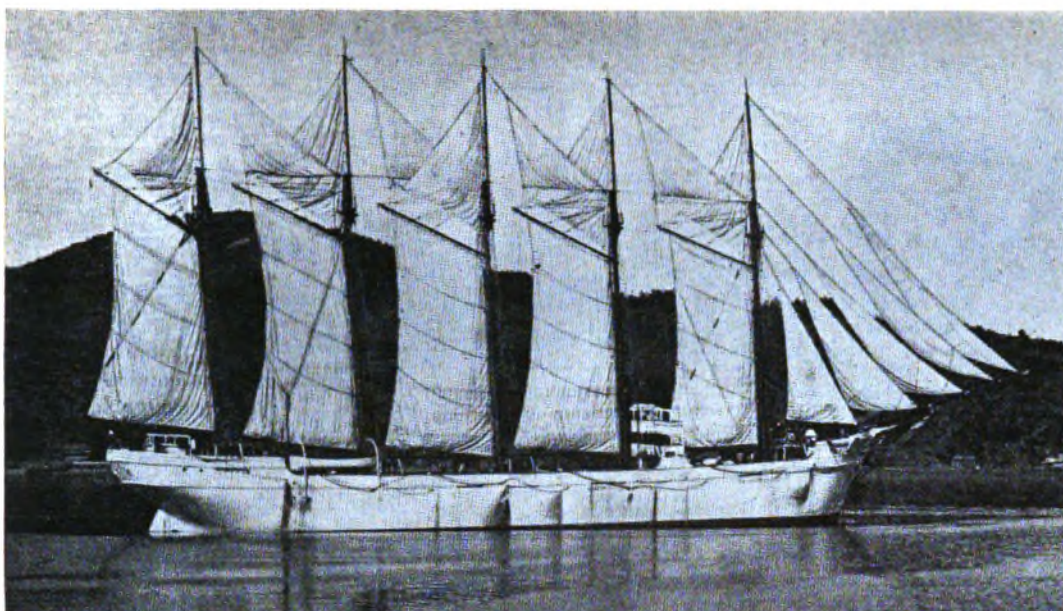
The engine is intended for use as auxiliary power only and generates but 120 H.P., the Japanese owners realizing that the success of an auxiliary sailing-ship depends upon her being operated on an auxiliary—not as a full-powered vessel. The engine is of the surface-ignition hot-bulb type, but for reasons not explained by the officers of the ship, is run entirely on kerosene, which is found rather expensive for operating under present conditions and is in contradiction to some of the remarks we have just made. Its normal speed is 280 to 290 R.P.M., and at these revolutions is able, according to officers of the vessel, to drive her at a speed of about 4 knots. They state that the power is too small to be of much use except in calms, or in docking or maneuvering in close quarters. Thus, as the schooner can make 10 knots under sail with a good wind, the engine was used very little after leaving Japan until the vessel entered Pu-



The m.s. "Jiro Maru," a new vessel of 840 tons gross (about 1350 tons d.w.c.). She is owned by the Mitou Bishi Goshi-Kaisha of Tokyo, Japan. Length 180 ft., Breadth 32 ft., Depth 22 ft., Power, one 360 B.H.P. Niigata oil-engine



An oil-engined winch built by the Niigata Engineering Works, Tokyo, Japan



"Hotaka Maru," Japanese motor-auxiliary sailing-ship fitted with a 280 B.H.P. Niigata surface-ignition oil-engine

get Sound, when it was found a great convenience in moving between docks, etc.

The propelling machinery is installed amidships, fuel being carried in a steel tank in the forward starboard corner of the engine-room, whereas all American auxiliaries have their motors aft. Starting-air at a pressure of 100 lbs. is carried in a small tank suspended in the after end of the engine-room, and is supplied by means of a small air-pump which can be operated either by a hand-crank or by a belt from the main shaft. There is also a small air-tank, with a hand-pump, to blow the heating torches for the hot-bulbs. Reversing is accomplished by means of a gear, which is operated by a hand-wheel just abaft the engine.

The builders of the "Houzan Maru's" engine have for some time been building engines of similar type, but for the most part of smaller size, for use in Japanese fishing-boats as referred to above. The "Houzan Maru's" accommodations for officers and crew were built and arranged quite in accordance with Oriental standards, with low head-room and little in the way of luxury or conveniences, even in the officers' quarters, which are situated under a low poop-deck that is surmounted by a small pilot-house, while the crew is housed under the forecastle head. Deck auxiliaries are notable by their absence, the anchor being hoisted by means of a hand-winch on the forecastle head. She carries a crew of 15 seamen and 6 officers.

The trip to Puget Sound under charter to Mitsui & Co., was the "Houzan Maru's" second ocean voyage, the first having been to Kamchatka for salt salmon. She left Yokohama Dec. 9, and on the 14th ran into a heavy storm, which carried away the foremast and stove in a part of the rail. After discharging, and stepping a new mast at Seattle, she left for San Francisco to load salt and general cargo for the return voyage to the Orient.

It must not be thought that all the surface-ignition engined Japanese vessels are small wooden auxiliaries, as some of them are full-powered

steel ships engaged in the coastwise traffic and in trading with China, etc., not to overlook the coming fleet of large full-powered Diesel-driven ocean freighters and cargo-passenger ships.

For instance there is the "Jiro Maru," a steel boat of 850 tons gross, which we illustrate. This vessel was built this year and is a sister motorship of the "Ichirs Maru," a cargo boat of 840 tons gross. Both have the following dimensions, but the engines differ in power, which may account for the slight difference in tonnage.

Length180 ft.
Breadth32 ft.
Depth22 ft.
Power360 B.H.P.

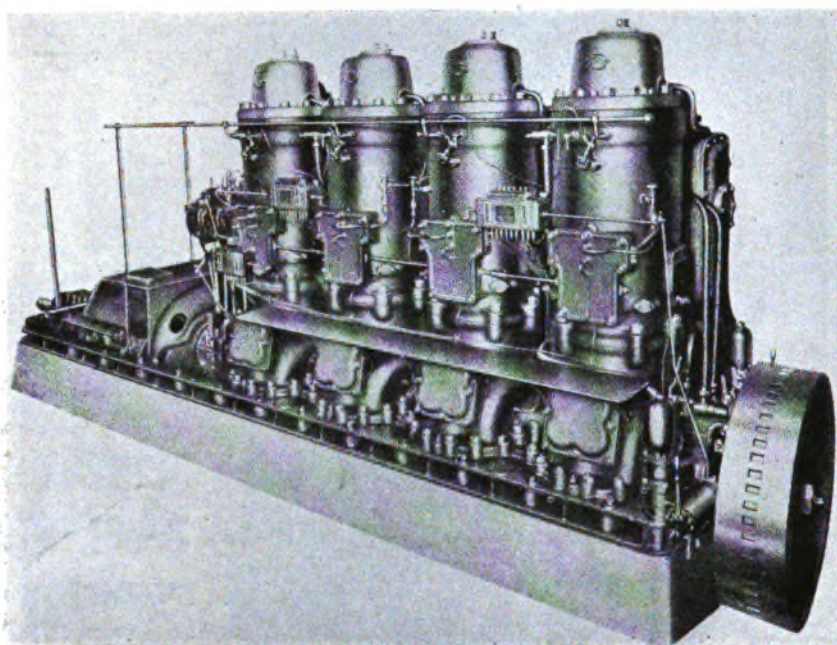
The "Jiro Maru" is driven by a four-cylinder 17% in. bore by 20 in. stroke, heavy-oil engine constructed by the Niigata Tekkosho (Niigata Engineering Works Ltd.), who have works at Tsukishima, Kyobashi-Ku, Tokyo, and their head office at Yurakucho, Kojimachi-Ku, Tokyo. We also give an illustration of the Niigata surface-ignition 360 B.H.P. oil-engine.

The "Ichirs Maru" was built last year for the Mitoa Bishi Goshi Kaisha, of Tokyo, and was fitted with a four-cycle, 16 1/2 in. bore by 19 in. stroke, heavy-oil engine, by the Ikegai Ironworks of Tokyo.

Among other motor vessels engined by the Niigata Engineering Works are the following:

Name of Vessel	Type	No. of Engines	Total Power
"Fumitsuki Maru V".....	Auxiliary	2	280 B.H.P.
"Taiye-Maru".....	Auxiliary	2	120 B.H.P.
"Fumitsuki Maru I".....	Auxiliary	2	160 B.H.P.
"Koshi Maru II".....	Auxiliary	2	160 B.H.P.
"Hotaka Maru".....	Auxiliary	1	280 B.H.P.

Two of the above vessels we illustrate in this issue of "Motorship." Whether this company intends competing against American motors on the American and Canadian coasts of the Pacific and in foreign markets in general we cannot say; but, we have before us a copy of their catalogue, which is printed in excellent English, and also illustrates a number of fishing-boats, tugs, and launches powered by them, apart from stationary oil-engines, and ships electric-lighting sets, pumps, air-compressors and winches,—all oil-engine driven. The cheap labor conditions existing in Japan would offset the American customs-duty of 20%, which by the way does not apply to imported engines when installed in existing vessels. At least, it indicates not a little enterprise on the part of the Japanese, and the same may indicate that extensive competition might soon be expected from Japan.



A four-cylinder, two-cycle type 360 B.H.P. surface-ignition marine oil-engine built by the Niigata Engineering Works, Tokyo, Japan, and installed in the motorship "Jiro Maru"

ered by them, apart from stationary oil-engines, and ships electric-lighting sets, pumps, air-compressors and winches,—all oil-engine driven. The cheap labor conditions existing in Japan would offset the American customs-duty of 20%, which by the way does not apply to imported engines when installed in existing vessels. At least, it indicates not a little enterprise on the part of the Japanese, and the same may indicate that extensive competition might soon be expected from Japan.

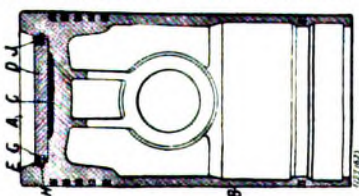
"Motorship" Illustrated Patent Record*

Selected Abstracts of Recent Published Patents of Internal Combustion Engines

Copies of original specifications may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."

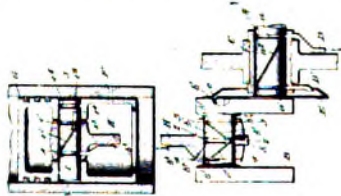
*Compiled and described by H. Schreck, Memb. Amer. Soc. Mech. Eng'rs

122,162. Oct. 28, 1918. Piston, North British Diesel-Engine Wks. Ltd., Whiteinch Glasgow, and J. C. MacC MacLagan, of Glasgow (British Patent).
This invention relates to a special design of a piston bottom. In order to prevent or lessen the possibility of the crown becoming



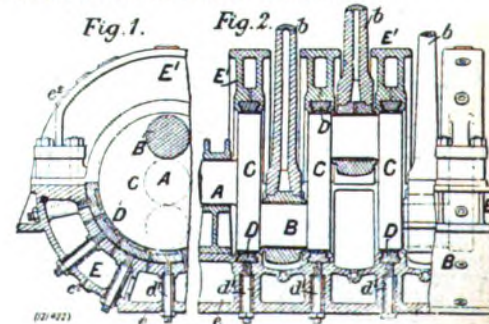
overheated a protective metal plate is inserted in the head. A circular recess A is formed in the crown of the piston. In the bottom of this recess is a depression C which is filled with asbestos and within the recess is fitted a protective plate D which is retained in position by a split ring E.

1,292,312. Jan. 21, 1919. Lubrication. C. R. Gronkwist, of Katrineholm, Sweden.
This patent refers to a special arrangement of lubrication of bearings and pistons, particularly on oil-engines. The oil is supplied



plied under a constant pressure into the main bearings at D. Proper grooves are provided on the journals and in the bearings so to have a continuous system which will supply the oil to every bearing at a pre-determined rate.

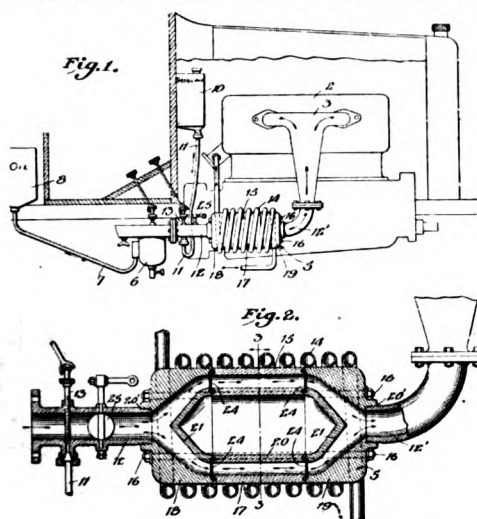
121,422. April 17, 1918. Crankshafts and Bearings. Vickers, Ltd., Westminster, London, and Sir J. McKechnie Barrow-in-Furness (British Patent).



This invention relates to a construction of a crankshaft on which the discs carrying the crank pin or pins are mounted directly in journal bearings of the oil film or Michell type, comprising a series of separate spaced bearing blocks supporting the discs through a film of lubricant.

1,291,564. Jan. 14, 1919. Fuel Heater, S. J. Lavender, of Barnesville, Georgia.

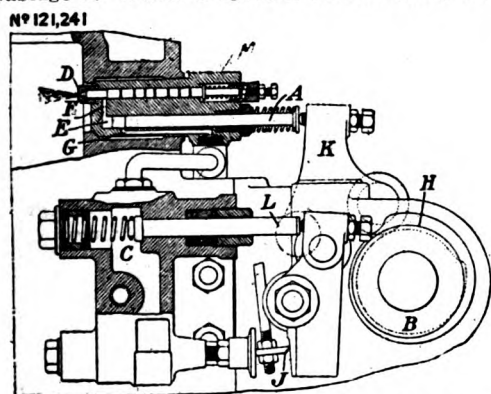
This invention relates to the heating of vaporous fuel on a combustion engine. The engine may be started on gasoline which is admitted at 11 and shut off as soon as the engine is running and a



lower grade fuel supplied from tank 8. The latter fuel is vaporized in carburetor 6 and by passing through a heated retort a mean is provided to increase the vaporization of the low grade fuel, as kerosene, before it passes into the motor.

121,241. March 21, 1918. Fuel-Valve of Semi-Diesel Engine. H. N. Bickerton, of Ashton-under Lyne, England (British Patent).

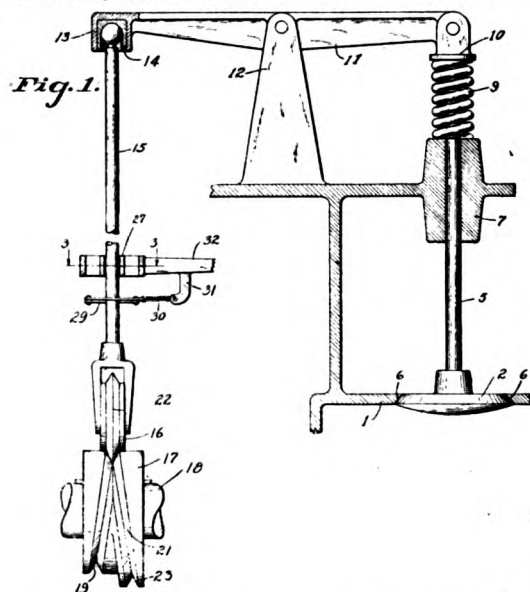
The object of this invention is to prevent the spilling of oil into the engine cylinder when the injection has ceased. The inventor provides between the fuel-pump C and the injection device D to G a chamber E whose front and communicates with the injection orifice by a passage F. A cam H operates the fuel-pump whose



admission-valve is under the usual control of the governor by means of a distance-piece J, which will vary the amount of oil delivered. The admittance of the oil pumped to the injection-valve will be controlled by the plunger A which is actuated by lever K and cam B. When the oil is entering into the chamber E and port F it will open by its pressure the valve needle against the action of spring M.

1,286,281. Dec. 3, 1918. Valve Gear, J. Gerard, of Green Bay, Wis. Assignor to Crankshaft Valve Movement Co. of Green Bay, Wis.

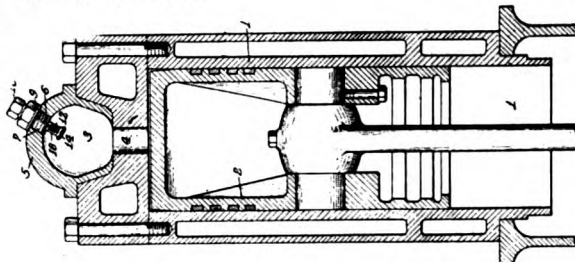
This invention refers to a valve motion, which is actuated by a cam. The cam carries a set of V grooves



which are crossing each other, and the cam roller is held in such a position that it works either in the one or the other groove, of which one may be shaped for the ahead motion, the other for the astern motion of the engine.

1,280,748. Oct. 8, 1918. Oil Engine Igniter. G. H. Jernberg, of Bayonne, N. J.

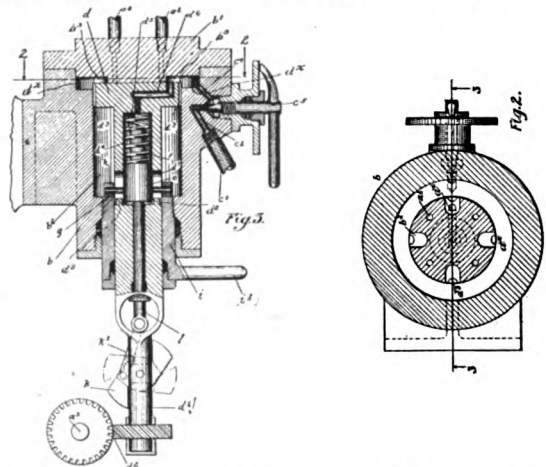
The object of this invention is to provide simple, positive and durable means for effecting electric ignition of the combustion mixture in starting, and protecting the electric ignition element from the effect of high temperature and combustion products during normal operation.



An ignition element 12, in the form of an electrical resistance, such as nickel chrome wire, which becomes incandescent when connected with a suitable current source, is extended into the combustion chamber. This element can be withdrawn from the explosion heat by screwing outward the stem 14 tight against the inner seat of plug 6 after the engine is once started.

1,292,981. Jan. 28, 1919. Fuel Distributing Device. C. W. Weiss, of Brooklyn, N. Y.

This invention relates to the control of the supply of fuel on internal combustion engines. The illustration shows this device for a four-cylinder engine. The fuel is supplied under constant pressure at c' and enters through suitable ducts c', c', and d' into the oil chamber b'. The oil will also flow through passage d' and



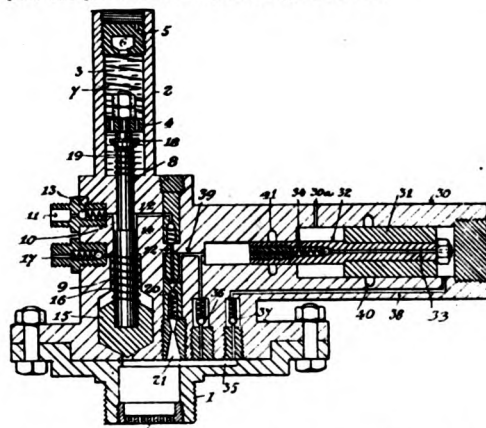
fill the space above the little piston e. A distributor head d is revolved by the distributor shaft d' and thus the opening of the duct d' will register successively with the various openings to the pipes a' which are leading to the respective cylinders. As soon as these said openings register, the oil pressure of the oil chamber b', transmitted through the slots d', and acting on the lower face of the piston e will force the oil contained in barrel d' into the respective cylinder.

The stroke of the piston e is limited by a slidable rod 1, which is controlled by a governor of the engine.

1,292,347. Jan. 21, 1919. Apparatus for Fuel Injection. W. H. Martyn of Tenterfield, New South Wales, Australia, Assignor to T. H. Martyn, of Sydney, New South Wales, Australia.

This patent refers to a method of fuel injection on which the compressed air of the working cylinder proper is utilized for this purpose. The device as shown is attached directly to the cylinder head.

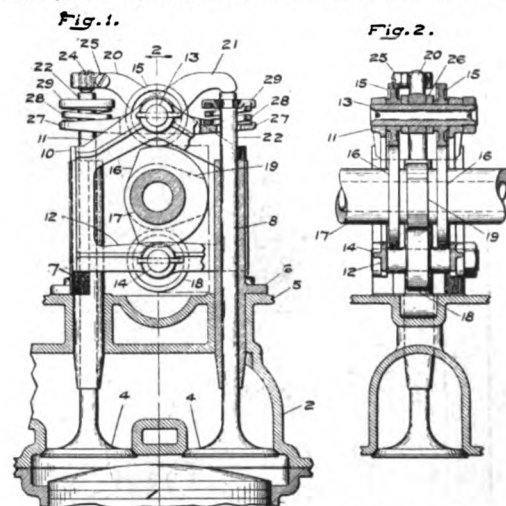
The fuel is supplied at 11 and enters the measuring chamber 10 which is formed by the annular space around the plunger 8. The movement of this plunger is checked by the dash pot 4, that is, it will measure the speed at which the fuel will be supplied to the engine. The fuel itself is forced from this measuring chamber through passage 12 and back pressure valves 14 and 20 to the spray nozzle 21 by the action of the compressed air from the cylinder on the lower side of the plunger block 15. Any leakage of oil past the piston can escape through valve 17.



The lateral cylinder 30 contains an appliance for the atomization of the fuel, 36 is a relatively weak spring back pressure valve and 37 a valve with a strong spring. While the compression in the working cylinder is still low, air will be admitted through 36 into the space below the plunger 32, pushing back the plunger and piston. But as the pressure in the cylinder increases, the valve 37 will open and admit compressed air through passage 38 behind the piston. This will drive the piston ahead, close valve 36 and let additional air pass through passage 33 of the piston and it will pass through passage 39 and unite with and assist to atomize the fuel. The channels 40 and 41 may be filled with a liquid to serve as packing.

1,291,264. Jan. 14, 1919. Valve Operation. F. I. Tone, of Indianapolis, Ind.

This invention refers to an arrangement which provides positive means for opening and closing of valves. The illustration may either represent a pair of inlet valves or a pair of exhaust valves.

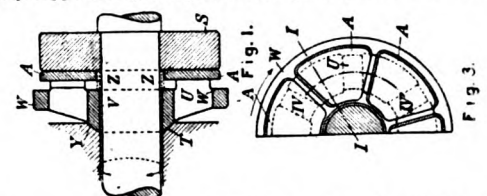


Two similar frame members 10 are provided, held together with bolts 13 and 14 and are carrying the lower single roller 18 and the two upper rollers 15. The camshaft which runs through this frame construction carries the cam 19 in the center and the two side cams 16, the former bearing against the lower roller and is thus closing the valves, whereas the latter two cams are bearing against the two upper rollers and in that way are opening the valves.

123,010. Feb. 2, 1918. Thrust bearing. A. G. M. Michell, Melbourne, Australia (British Patent).

This patent covers a development of the original Michell thrust bearing. This bearing, as it is well known, transmits the thrust on a plurality of blocks which are made sufficiently flexible so to allow an equal distribution of the load and a better entrance for the lubricating oil.

In the accompanying illustration Fig. 1 is an axial section of the thrust bearing and thrust collar on line II of Fig. 3. The bearing blocks A, six in number, form an annular series, being rigidly supported by being formed as parts of a common casting



which transmits the thrust from the rotating collar S to the fixed casing T of the machine. Each of the thrust blocks is relatively thick at its point of support, but is reduced in thickness in its leading portion, the motion being in one direction only as indicated by the arrows. Each block is attached to and supported by one of the ribs or spokes U of the casting, these spokes being attached to the central boss V, and connected together for the sake of additional strength and rigidity by the peripheral ring W. The rear side of the boss V may be formed with a spherical surface Y fitting a corresponding spherical seat in the casing T, and so permitting the whole casting to swivel and distribute the total pressure equally between the various blocks A.

THE MICHELL THRUST-BLOCK Extension of Patent Granted

The Courts of Great Britain have granted extension to the patent No. 875, 1905, on the Michell thrust-bearing, which decision will be of interest to our readers as this device is based on the same principle as the Kingsbury thrust-block which is so well known to every American engineer and on which we reported in these columns last October, and which is being used with many Diesel engines.

Mr. Michell is an Australian engineer, and prior to 1905 he made an exhaustive scientific study of the theory of lubrication and finally evolved the thrust-block which bears his name. The outstanding feature of this thrust-block is that the whole load exerted by the propeller is taken on a single collar and that the frictional loss is only about one twentieth of the ordinary multi-collar type.

Efforts were made to introduce the new thrust-block in Great Britain; but, it was not until recently that the Michell thrust-block came into its own: It is now quite common practice to transmit shaft horse powers exceeding 20,000 through single collars, and shafts capable of transmitting double this power are at present being fitted with the Michell thrust-block.

Messrs. Cammell Laird, of Birkenhead, England, were among the first to recognize the advantages of the invention. In 1913 they installed Michell thrust-blocks in two ships for South America. Every since they have been earnest advocates of the system and have manufactured Michell thrust-blocks for vessels aggregating 1,036,000 Horse-power, all built at Birkenhead, and comprising all classes of machinery, viz. Turbines geared and direct driven, Reciprocating steam engines, and Diesel type internal-combustion engines.

War stopped all enterprise and development in Mercantile work; but the British Admiralty after running their first destroyer with Michell thrusts in August 1914 adopted it universally. They have now in service or under construction over 9½ million horse-power with Michell thrust-blocks. Where the Naval Authorities have given such a lead it may not be too much to expect that Mercantile Ship-owners will follow, and there are good indications that in the near future the multi-collar thrust-block, with its complication and inefficiency and expense and waste of valuable space will be entirely displaced by its more scientific and neater rival. On the score of expense reduction Mr. J. Hamilton Gibson, of Cammell Lairds, in his evidence said that the adoption of the Michell thrust in one of His Majesty's battle-cruisers resulted in a saving in first cost of £190,000.00, as compared with the old type of Thrust and the Royalty payable to the patentee was just \$500.00. Mr. H. T. Newbigin of Newcastle, Michell's agent in Great Britain, showed that the annual saving in Coal and Oil due to reduced friction was at least \$4,000,000.00 in the Navy alone. Mr. Newbigin also has a patent and this was dealt with in the April 1919 issue of "Motorship".

In view of all these facts, and many others which we have not space to record, the learned judge decided that it was only fair to the inventor that he should have an opportunity of reaping some more adequate reward now that the war is happily over and normal commercial conditions are in sight, and he granted an extension of the patent for the full period allowed by statutory law, namely, 7 years. The Attorney General, Sir Gordon Hewart, K.C., opposed on behalf of the Crown, but as there was no trade opposition to the petition, the Crown was merely concerned in limiting the period of extension, whilst "freely acknowledging the value of this invention."